

MEDLEY FARM SITE

REMEDIAL DESIGN AND REMEDIAL ACTION

Field Sampling and
Analysis Plan

Quality Assurance
Project Plan

Prepared for the
Medley Farm Site Steering Committee

By

RMIT^{INC.}

100 Verdae Blvd.
Greenville, South Carolina 29607

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MEDLEY FARM DRUM DUMP
CHEROKEE, BLACKSBURG
UNORGANIZED SITE FILE
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RMT, Inc.
100 Verdae Blvd.
P.O. Box 16778
Greenville, SC 29606
Phone: 803-281-0030
FAX: 803-281-0288

**MEDLEY FARM SITE
GAFFNEY, SOUTH CAROLINA**

REMEDIAL DESIGN AND REMEDIAL ACTION

FIELD SAMPLING AND ANALYSIS PLAN

June 1992

*Prepared for the
Medley Farm Site Steering Committee*

A handwritten signature in black ink, reading "Mark A. Miesfeldt".

Mark A. Miesfeldt
Project Hydrogeologist

A handwritten signature in black ink, reading "Steve W. Webb".

Steve W. Webb, Ph.D., P.E.
Project Coordinator

A handwritten signature in black ink, reading "David G. Nichols".

David G. Nichols, P.G.
Project Manager

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PREFACE

On January 17, 1992, a Consent Decree was entered into by the United States Environmental Protection Agency (US EPA) and the Medley Farm Site Steering Committee. As a part of this agreement, the Medley Farm Site Steering Committee agreed to provide the US EPA with the following documents within 45 days of US EPA's issuance of an authorization to proceed dated January 19, 1992:

- Field Sampling and Analysis Plan (FSAP),
- Quality Assurance Project Plan (QAPP),
- Health and Safety Plan, and
- A Technical Memorandum describing the Site Remedial Objectives.

The FSAP and QAPP are addressed within this document. The remaining submittals have been provided the US EPA under separate cover.

Section 1 INTRODUCTION

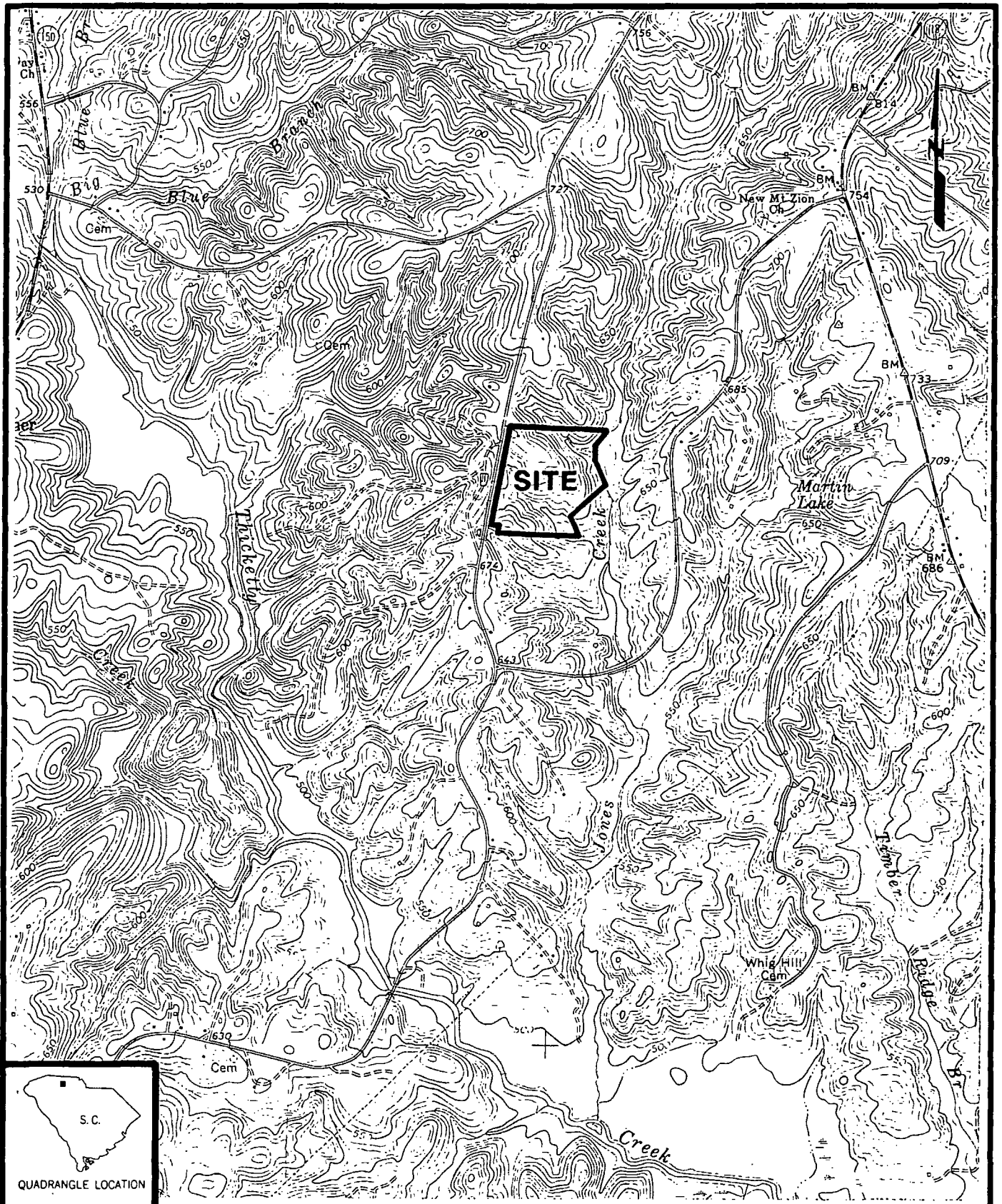
The Medley Farm property consists of 61.9 acres of rural land located approximately six miles south of Gaffney, South Carolina in Cherokee County. The Medley Farm Site (Site) as defined in the Record of Decision, occupies approximately seven acres of the 61.9 acre tract. The location of the Medley Farm property and Site are shown on Figure 1-1. Land surrounding the site is primarily pasture land and forest. Land use in the area is primarily agricultural and light residential. No change in land use of the Medley Farm property is expected in the near future.

1.1 Background

The Medley Farm property is currently owned by Ralph C. Medley, who acquired the property from William Medley in 1948. Prior to the mid-1970s, the property was maintained as undeveloped woodlands and pasture. Based on available information, the disposal of drummed and other solid waste materials at the Site began in 1973 and terminated in June 1976. The South Carolina Department of Health and Environmental Control (SC DHEC) visited the Site on May 3, 1983. At the time of the visit, SC DHEC estimated that approximately 2,000 55-gallon drums were on-site. Drums were found in open pits, several small lagoons, and scattered on the ground. In addition to the 55-gallon drums, there were numerous plastic containers of various sizes. No formal records regarding the disposed waste materials were maintained by either the property owner or the Principal Responsible Parties (PRPs).

Based on their initial inspection, SC DHEC returned on May 19, 1983 to collect soil samples for analysis. The results of these analyses showed the presence of a number of volatile organic compounds (VOCs) including methylene chloride, trichloroethylene (TCE), and trans-1,2-dichloroethylene as well as several semivolatile organic compounds (SVOCs).

SC DHEC informed the U.S. Environmental Protection Agency (US EPA) of the sampling results and US EPA visited the Site during the week of May 30, 1983. During the US EPA visit, additional samples were collected for analysis. Among the compounds detected in US EPA's samples were: methylene chloride, vinyl chloride, perchloroethylene (PCE), phenol, toluene, TCE, and 1,2-dichloroethane. One composite soil sample was found to contain low levels of polychlorinated biphenyls (PCBs).



PACOLET MILLS QUAD.

RMT^{MC} 938.04
0292

FIGURE 1-1
SITE LOCATION MAP
SCALE: 1"=2000'

MEDLEY FARMS
GAFFNEY, SC.

An immediate removal action was initiated on June 10, 1983 by US EPA pursuant to Section 104 and other provisions of the Comprehensive Environmental Response, Compensation, and Liability act of 1980 (CERCLA). A total of 5,383 55-gallon drums and 15-gallon containers were removed from the Site. These included full, partially full, and empty containers. The solid waste and soils, totaling 2,132 cubic yards, were taken to an approved hazardous waste landfill. This interim remedial action was completed on July 21, 1983.

Analytical testing of the drum contents, as well as the water and sediment in the lagoons during the removal action, confirmed the presence of the following volatile organic compounds: toluene, benzene, methylene chloride, perchloroethylene, and vinyl chloride.

Following the removal action, US EPA directed one of its Contractors to conduct a geological and geophysical study. This study was completed in August 1983. This study was designed to determine the potential for ground water effects at the Site. The field study included electrical resistivity soundings, a magnetometer survey, and an electromagnetic (EM) survey. Anomalous areas identified during these geophysical surveys correlated with the former drum storage and lagoon locations.

SC DHEC revisited the Site in April 1984 to perform additional site investigations and install a ground water monitoring well (MD2A). Soil samples from two boreholes and a ground water sample collected from the newly installed monitoring well were analyzed for volatile organics, drinking water metals, and acid and base-neutral extractables. The results of the soil analyses identified the presence of methylene chloride and 1,2-dichloroethane at a depth of 10 feet. Results of the ground water analyses conducted in April 1984 and July 1984 are presented in Table 1-1.

The Site was proposed for inclusion on the National Priority List (NPL) in June 1986 and was finalized on the NPL in March 1990. As of August 1990, the Site ranked 918 out of 1218 NPL sites.

The Remedial Investigation (RI) was conducted by Sirrine Environmental Consultants (SEC) and occurred in two phases. Phase I began in January 1988, with the signing of the Administrative Consent Order (ACO), and ended with the submission of a draft RI report in March 1990. As a result of data gaps identified by this report, Phase II of the RI was conducted. The revised RI report

TABLE 1-1
MEDLEY FARM SITE RI
SC DHEC VOLATILE ORGANIC GROUND WATER ANALYSES

SC DHEC MONITORING WELL ON THE MEDLEY FARM SITE

WELL MD2A	DATE OF COLLECTION	
	APRIL 13, 1984 (1)	JULY 18, 1984 (2)
1) methylene chloride	39.05 µg/L	9.22 µg/L
2) 1,1-dichloroethene	1,887.00 µg/L	1,645.00 µg/L
3) 1,1-dichloroethane	160.5 µg/L	43.7 µg/L
4) trans-1,2-dichloroethene	37.9 µg/L	28.0 µg/L
5) chloroform	8.0 µg/L	3.56 µg/L
6) 1,2-dichloroethane	22.05 µg/L	7.53 µg/L
7) 1,1,1-trichloroethane	3,362.00 µg/L	2,188.00 µg/L
8) carbon tetrachloride	3,804.00 µg/L	830.00 µg/L
9) trichloroethene	6.6 µg/L	3.14 µg/L
10) 1,1,2-trichloroethane	66.9 µg/L	15.3 µg/L
11) toluene	29.6 µg/L	*
12) perchloroethylene	2.5 µg/L	*

* No value given in SC DHEC analytical results.

References: 1. Workman, 1984(a)
2. Workman, 1984(b)

including Phase II results, was submitted to US EPA in November 1990 and the draft Feasibility Study (FS) was delivered in December 1990. The US EPA approved both the RI and the FS in May 1991, and issued their Record of Decision (ROD) for this site. In January 1992 the US EPA issued a Consent Decree requiring the Medley Farm PRPs to conduct additional work designed to investigate ground water quality in the northwest quadrant of the site, as well as initiate the Remedial Design (RD) and Remedial Action (RA) process for this site. The Field Sampling and Analysis Plan (FSAP) in this document describes the work that will be done to address US EPA requirements to study ground water quality in the northwest quadrant of the site.

1.2 Purpose

The purpose of the Field Sampling and Analysis Plan is to establish data collection activities which are compatible with the site remedial objectives for this project, and to provide a mechanism for planning and approval of the proposed field activities. This FSAP provides a description of the supplemental fieldwork by defining the sampling approach and data-gathering methods to be used during their investigation. The Quality Assurance Project Plan (QAPP) submitted along with the FSAP due to their combined use as the Sampling and Analysis Plan.

1.3 Scope

The Scope of this FSAP is based on the following key project documents:

- US EPA Administrative Consent Decree and Statement of Work,
- Medley Farm Site Record of Decision, and
- The EPA-approved Medley Farm Site RI and FS.

The field activities described in Section 3 of this FSAP are designed to address requirements raised by US EPA in the Record of Decision and Consent Decree by better defining ground water quality in the northeast quadrant of the site. The scope of this investigation includes the following:

- Performance of a ground water screening survey using In-situ Technology's Hydrocone® sampling system along the tributary of Jones Creek extending northwest of the existing monitoring well pair identified as SW-108/BW-108. The Hydrocone® survey is designed to assess the horizontal extent of VOCs that may be present in the ground water.

- Conduct ground water screening analyses in the field using a portable gas chromatograph. Ground water samples will be collected from near the water table and analyzed in the field for the volatile organic compounds that have been previously detected in well SW-108. Samples containing VOC concentrations below the quantification limit of the field instrument will be sent to an analytical laboratory for verification analysis.
- Based on the results of the ground water screening survey, two water table monitoring wells (SW-201, SW-202) will be installed to assess the horizontal extent of VOCs and SVOCs along the creek and northwest of the former disposal area.
- Since the ground water screening survey will not address water quality in the bedrock, two additional bedrock monitoring wells (BW-201, and BW-202) will be installed. These wells will be installed adjacent to the location of the proposed water table monitoring wells to better define the extent of VOCs in the bedrock along the creek and northwest of the former disposal area.
- Ground water samples will be collected from the newly installed wells and analyzed for the volatile and semivolatile portions of the Target Compound List (TCL).
- Depending upon the results of the initial quarterly monitoring activities being conducted in February 1992, additional surface water and stream sediment samples may be collected from two locations in the creek (designated as RW-07, RW-08 and SS-07, SS-08). If necessary, these samples will be analyzed for the volatile and semivolatile portions of the TCL.

Section 2

SAMPLING OBJECTIVES

The data gathering and analytical activities proposed herein are intended to confirm and supplement the nature and extent of constituents within the various media as determined during previous investigations. The data must be of sufficient quantity and quality to allow Remedial Design and Remedial Action (RD/RA) to be conducted efficiently.

The following objectives have been developed for these supplemental field activities:

- collect additional ground water quality data in the northwest quadrant of the site.
- fill data gaps within the existing database, and
- further characterize the hydrogeologic and geologic parameters that will influence the Remedial Design.

Data will be collected in stages, with the supplemental data collection efforts being primarily focused toward better assessing the horizontal extent of affected ground water in the northeast quadrant. Subsequent data collection efforts may be identified to fill data gaps identified during the RD/RA process. This phased sampling approach is intended to enable a thorough review of the existing data and to permit collection of additional data relevant to the design efforts during later stages of the project. Using this approach, it is expected that the overall site characterization effort can be completed with a minimum number of data points necessary to provide the maximum possible data quality.

Section 3 SAMPLE LOCATION AND FREQUENCY

This section presents the field and analytical program for supplemental field studies. The scope of work is intended to better evaluate the presence, nature, and extent of affected ground water identified during previous investigations. The information to be obtained will also serve as the basis for subsequent RD/RA activities.

The sampling plan for the Medley Farm Site is based on discussions with US EPA and the results of previous investigations. The types of samples to be collected include ground water samples, and possibly surface water, and stream sediment samples depending on the results of the initial quarterly sampling results. Table 3-1 summarizes the type and number of samples that may be collected during the investigation.

**TABLE 3-1
SUMMARY OF SAMPLING PROGRAM**

Sample Type	Sample Designator	Number of Samples	Number of Duplicates	Number of Field/Rinsate Blanks	Number of Trip Blanks
Ground Water	BW or SW	4	1	1	1/VOA cooler
Surface Water (optional)	RW	2	0	0	1/VOA cooler
Stream Sediment (optional)	SS	2	1	0	1/VOA cooler

Duplicate samples, field blanks, and trip blanks are methods of Quality Assurance (QA) and are discussed in the QAPP. Laboratory QA samples, such as matrix spikes and matrix spike duplicates, are also discussed in the QAPP.

The sample locations and the area of the ground water screening survey are shown on Plate 3-1 (located in a pocket following Appendix A). The scope of these supplemental activities is intended to evaluate the extent of the affected ground water in the northeast quadrant of the site. Sampling methods, chain-of-custody, preservation and equipment procedures used to perform the Scope of Work are designed to comply with the US EPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual (SOPQAM), issued February 1, 1991. Samples will be

analyzed for the volatile and semivolatile portions of the Target Compound List (TCL). If volatile or semi-volatile organic compounds are detected in the surface water or stream sediments collected during the first quarterly monitoring event, subsequent surface water and sediment samples will be collected and evaluated for the volatile and semivolatile portions of the TCL. Since these results have since shown the tributary to be clean, it is not anticipated that further sampling of this stream will be necessary for purposes other than NPDES permitting.

3.1 Surface Water

Based on the results of the supplemental RI field activities, surface water samples may be collected from the tributary of Jones Creek that borders the site to the east. The purpose of the samples would be to evaluate the presence of VOCs and SVOCs and address NPDES permitting requirements. If needed, surface water samples RW07 and RW08 would be obtained from the locations shown on Plate 3-1, according to the procedures described in Section 5.4. If during the supplemental field activities ground water seeps or springs are identified in the northeast quadrant of the site, additional surface water samples may also be collected. Sample station RW07 is intended to provide background surface water quality data. Samples RW07 and RW08 would be analyzed for the volatile and semivolatile portions of the TCL. Sample station RW08 will be located in an effort to assess whether or not VOCs or SVOCs are discharging to the surface water.

3.2 Stream Sediment

Stream sediment samples may also be collected to determine the presence of VOCs or SVOCs which may have become deposited in the stream as a result of either surface runoff or stream flow. If appropriate, sediment samples would be collected at sites SS07 and SS08, adjacent to the surface water samples, as shown on Plate 3-1. Samples will be collected by the scoop collection method as described in Section 5.4 of this plan. Sediment sample SS07 is intended to provide background data for the stream. Samples SS07 and SS08 would also be analyzed for the volatile and semivolatile portions of the TCL. Sample SS08 is located at the same downstream position as RW08. Sediment quality data for SS08 will be compared to the results for SS07 to evaluate whether or not stream sediment has been affected. Sample SS07 will be located at the upstream property boundary to assess the potential for an off-site source area.

3.3 Ground Water

3.3.1 Ground Water Screening Survey

A ground water screening survey is proposed to better delineate the horizontal extent of VOCs in the ground water north of well pair SW-108 and BW-108. Data presented in the Medley Farm RI report indicates that the stream, which borders the site to the east, is a ground water discharge area. Therefore, the ground water screening survey will be conducted to assess water quality conditions near the water table. The results of this survey will be used to determine the location of confirmation monitoring wells.

In situ ground water samples will be collected from the area shown on Plate 3-1. The survey will begin near existing well pair SW-108/BW-108 and proceed to the north along the unnamed tributary of Jones Creek until field VOC concentrations are observed to fall below their respective MCLs. *In situ* ground water samples will be collected using In-Situ Technology's "Direct Push Technology", further discussed in Section 5.6. Ground water obtained using this system will be screened in the field for volatile organic compounds using a portable gas chromatograph. The survey area may be expanded if the extent of affected ground water is found to be greater than anticipated.

3.3.2 Monitoring Well Installation

Following the ground water survey, a minimum of four ground water monitoring wells will be installed on-site. The wells (SW-201, BW-201, SW-202, and BW-202) will be tentatively installed at the locations shown on Plate 3-1. The precise location of the monitoring wells is subject to change based on the results of the ground water screening survey. Monitoring wells SW-201 and SW-202 will be installed to define the horizontal extent of site constituents at the water table. These wells will be installed outside the area currently known to contain VOCs. Since the ground water screening survey will not address water quality conditions in the bedrock, monitoring wells BW-201 and BW-202 will be installed to assess the extent of VOCs in bedrock. These wells will be installed adjacent to the shallow wells. Water quality information obtained from these wells will be used to enhance design of the ground water recovery system which will be described later in the RD Work Plan.

Drilling and well installation will be accomplished according to the procedures outlined in Section 5.7 of this FSAP. The location and elevation of the newly installed wells will be determined by a registered surveyor according to the procedures outlined in Section 3.4 that follows.

3.4 Surveying

The proposed monitoring wells, surface water, and stream sediment sample locations will be surveyed relative to the existing plant coordinate system and mean sea level (MSL) and the state plane coordinate system. Existing monitoring wells at the site have been surveyed previously by SEC.

Section 4

SAMPLE DESIGNATION, CONTROL, FIELD RECORDS, AND PHOTOGRAPHS

This section presents procedures for sample control, field records, and photographs. Sample control includes sample identification and chain-of-custody procedures.

4.1 Sample Designation

A sample identification system was previously developed for the Site by SEC. Samples will be assigned a unique alpha-numeric sample descriptor in accordance with that identification system that identifies the sample type, sample site number, and sample interval. For example: RW01 indicates that the sample was collected from river water (RW), and that it was the first sample collected (1). The first two letters specify the media type, followed by the sample numbers, and other descriptive data where appropriate. Sample descriptors will not contain hyphens and will use a zero to hold the place in single digit numerals for laboratory data entry purposes. The locations of samples, as illustrated on Plate 3-1, will contain hyphens and will not use zeros (e.g., RW-1).

Sample identification numbers will be included on both the chain-of-custody forms and sample containers. Duplicate samples will be given unique sample identification numbers which will be noted in the field book. Sets of containers shipped together will be assigned a chain-of-custody form which will travel with the sample containers. A copy of the chain-of-custody form with its assigned sample numbers will be kept in the laboratory to help identify samples which might become separated from the discrete sample delivery group.

4.2 Chain-of-Custody Procedures

By the use of chain-of-custody procedures, the handling of samples will be traceable from the time of collection to the time of final sample disposition. Field personnel will record the sample number, date and time of sample collection, personnel involved, type of sample, type of analyses to be performed, type of containers filled, volume of sample collected, and preservatives used. *In situ* measurements (e.g., pH, temperature) will be recorded in the sampling team's field notes.

Chain-of-custody forms will accompany sample containers to document the transfer of the containers and samples from the originating laboratory, through the field collection, and to the laboratory

receiving the samples for analyses. A sample container is under custody in the field if the following conditions exist:

- It is in the field investigator's actual possession;
- It is in the field investigator's view, after being in his/her physical possession;
- It was in the field investigator's physical possession and then she/he secured it to prevent tampering.

Chain-of-custody procedures are further discussed in Section 5 of the QAPP.

4.3 Field Records

4.3.1 Purpose

This section of the FSAP describes requirements and procedures for documentation of field activities. It is essential that all field documentation provide a clear, unbiased picture of field activities.

4.3.2 Procedure

Bound, serially numbered field notebooks will be used on work assignments requiring field activities. The On-Site Coordinator will be responsible for issuing the field notebooks. A record will be maintained by the On-Site Coordinator documenting the assignment of field notebooks. Entries into field notebooks will be legibly written in waterproof ink and provide a clear record of field activities.

The following information will be provided on the inside front cover or first page of the field notes:

- Project Name,
- Site Location, and
- Job Number.

Instructions for documenting field activities are provided below. These instructions are organized as follows:

- The first set of instructions and procedures described below, entitled "Format", provides general guidance relating to the format and technique in which notebook entries are to be made.

- The second set of instructions provided, entitled "Content", provides guidance on information to be recorded when documenting field activities.

Format

Instructions and procedures relating to the format and technique in which notebook entries are made are as follows:

1. Leave the first two pages blank. They will provide space for a table of contents to be added when the field notes are complete.
2. If photographs are taken as part of the field investigation, a brief photograph description will be made in the notes at the time the photograph is taken. Photograph descriptions will be numbered sequentially in the notes.
3. Entries will be made in waterproof ink.
4. Entries will be made in language which is objective, factual, and free of personal opinions or terminology which might later prove unclear or ambiguous.
5. Entries will be printed as neatly as possible.
6. Entries will be logged using a military-based 24 hour clock (e.g., 1 p.m. = 1300 hours).
7. Errors in the field notes will be indicated by drawing a single line through the text, the text of which will be left legible. Errors addressed in this manner will be initialed and dated.
8. A new page will be started at the beginning of each day's field activities and the remaining clear page at day's end will be filled with a single initialed diagonal line at the day's end.
9. The person taking notes will sign, number and date each page.

10. The On-Site Coordinator will complete a quality control check to verify that the notes are legible and contain an accurate picture of the day's field activities. This review should occur as soon as possible after the notes were taken. Copies of field notes will be made weekly and sent to the project file. The Quality Assurance Reviewer will be responsible for evaluating organization of the field notebook.
11. All subsequent additions, clarifications, or corrections to the field notes must be dated and signed.

Content

Instructions and procedures providing guidance on the information to be recorded concerning field activities are provided below:

1. A new page should be used at the start of each day's activities. Personnel will identify the date, time, job number, location on-site, field personnel, and observed weather conditions. Changes in weather will be noted when they occur.
2. Sketches or maps of the site will be included and used to identify photograph and/or sample locations. Landmarks will be noted, north will be indicated, and if possible, an approximate scale will be included. As many sketches and maps as needed will be included.
3. Field personnel responsible for note taking will log photographs taken in the field in the field notebook. The photograph locations will be referenced to a site sketch or map. Photograph information will include the date, time, location, photographer, sample number, roll number, frame number, and a description or identification of the subject in the photograph.
4. Use of on-site health and safety equipment will be recorded. Observed potential hazards to health and safety will be described. The level of protection and decontamination procedure used will be documented.

5. As part of the chain-of-custody procedure, sampling information will include sample number, date, time, sampling personnel, sample type, designation of sample as a grab or composite, and any preservative used. Sample locations will be referenced to sample numbers on a site sketch or map.
6. When sampling is complete, the field notes will include date, time, sample numbers, and **description**. The sample identification will also indicate whether the sample was a split or duplicate and the individual/company who received the split or duplicate sample.
7. Information for *in situ* measurements will include a sample ID number, the date, time, and personnel taking measurements. If in-field calculations are necessary, they will be checked in the field by a **second team member**, whenever possible.
8. Visitors arriving on-site, and relevant discussions will be recorded. The relevant information documented should include name of conversation **participants**, the name of the firm or group represented (if applicable), address, and phone number. The Project Manager or his designee shall be advised of all person(s) or groups entering the site.
9. All other information deemed relevant by the project team member will be recorded.

The On-Site Coordinator will distribute and track bound and numbered field notebooks. Transfers of field notebooks to other individuals (including subcontractors) who have been designated to perform specific tasks on the project will be recorded. Project notebooks are the property of the Medley Farm Site Steering Committee. No field notes may be destroyed or thrown away, even if they are illegible known to or contain inaccuracies.

4.4 Photographs

As discussed in Section 4.3, photographs taken in the field will be documented in the field notebook. After the film is developed, each slide or print will be labeled with the following information:

- job identification number,
- date,
- location,
- roll number,
- frame number, and
- sample number (if appropriate).

Section 5 SAMPLING EQUIPMENT AND PROCEDURES

Samples are collected to obtain a representative portion of the material or medium being sampled.

Valid results depend on the following:

- Obtaining samples that are as representative as possible of the material or medium being sampled;
- Using proper sampling, sample handling, and preservation techniques;
- Identifying the collected samples and documenting their collection in permanent field records;
- Maintaining sample chain-of-custody procedures; and
- Protecting the collected samples by properly packing and transporting them to a laboratory for analysis.

5.1 General Considerations

The following factors and procedures will be considered and/or implemented in planning and conducting sampling operations. These factors and procedures will be considered in view of the specific objectives and scope of the field investigation, as presented in this FSAP and the Quality Assurance Project Plan.

- Safety of sampling personnel.
- Selection of representative sampling sites.
- Selection and proper preparation of sampling equipment.
- Selection of parameters to be measured and evaluation of sample fractions to be analyzed (e.g., dissolved, suspended or total fractions for water samples).
- Required sample volumes.
- Selection and proper preparation of sample containers.
- Sample preservation.
- Sample holding times.
- Sample handling and mixing.
- Special precautions for trace constituent sampling.

- Sample identification.
- Procedures for identifying potentially hazardous samples.
- Collection of auxiliary data.
- Transportation and shipping of samples
- Sample chain-of-custody.

5.2 Terminology

Sampling terminology is defined as follows:

- **Grab Sample**
A grab sample is an individual sample taken from one point in space at essentially one point in time.
- **Composite Samples**
Timed Composite - A composite sample containing a series of discrete sample aliquots taken at recorded intervals over the compositing period.
- **Flow Proportional Compositional** - A sample containing a series of discrete sample aliquots taken proportionally to the flow rate over the compositing period.
- **Areal Composite** - A sample composited from individual grab sample aliquots collected over an area or in a cross-section. The grab sample aliquots will be of equal volume and shall be collected in an identical manner.
- **Split Samples**
A split sample is a sample which has been divided into two or more samples. Adequate mixing will be performed such that the two portions of a split sample are, for all practical purposes, identical. US EPA or its designee may from time to time desire to obtain split samples. US EPA is expected to provide their own containers for collection and shipping of samples. This procedure is appropriate for analysis of semivolatile organic compounds and inorganic constituents. Volatile organic samples need to be collected as discrete, grab samples.

- ***Duplicate Samples***

Duplicate samples are samples collected simultaneously from the same source under identical conditions into separate containers.

- ***Control or Background Samples***

Background or control samples are collected in an area known or thought to be free from the constituents of concern.

- ***Sample Aliquot***

A sample aliquot is a portion of a sample that is representative of the entire sample.

- ***Trip Blank***

A trip blank is a set of sample bottles, filled with organic-free water, that accompanies the empty sample bottles to the field and returns to the laboratory with the collected samples. The trip blank is used as a quality control check for the presence of volatile organics that might contaminate the samples.

- ***Field Blank***

A field blank is a set of sample bottles that are filled with organic-free, deionized water in the field. The organic-free, deionized water is handled in the same manner as the sample. Field blanks contain the same preservatives as the samples.

- ***Rinsate Blank***

A rinsate blank is a sample of organic-free, deionized water that has been passed across the surface of sampling equipment after the equipment has been decontaminated. The rinsate blank is used to check for the effectiveness of the field decontamination procedure between samples. One rinsate blank will be collected at random from each type sampling equipment (weekly) used during the soil sampling program. The rinsate blank sample analysis will be comparable to the analysis being performed on the soil sample.

5.3 Decontamination Procedures

Proper decontamination of sampling equipment is essential to minimize the possibility of cross contamination of samples. Sampling equipment will be decontaminated before sampling and between the collection of each sample, unless samples are to be composited. Sampling equipment will be decontaminated with materials specified in the ESBSOPQAM and according to the following procedures:

Step	Procedure
1.	Clean with tap water and laboratory detergent using a brush, if necessary, to remove particulate matter and surface films.
2.	Rinse thoroughly with tap water.
3.	Rinse thoroughly with deionized water.
4.	Rinse twice with pesticide grade isopropanol.
5.	Rinse thoroughly with organic-free water and allow to air dry.
6.	Wrap with plastic or aluminum foil to minimize the possibility of contamination if equipment is going to be stored or transported.

Larger equipment such as drilling and/or backhoe equipment that may contact the samples will be sand blasted at the time of mobilization to remove paint and rust. This equipment will be steam cleaned prior to initiating the field investigation. During the field investigation, drilling equipment such as drill augers and bits and sampling equipment such as split barrel samplers and drill rods will be decontaminated according to the procedure described above. Following decontamination, drilling augers, bits, split barrel samplers and rods will be wrapped in plastic or aluminum foil between borings. This includes transport from the decontamination area and temporary storage while awaiting use.

Water used for steam cleaning and drilling will be obtained from site water supply which is tied into the Gaffney Water system. This water supply will be sampled prior to the field phase of the investigation and analyzed for the volatile and semivolatile portions of the Target Compounds List.

Since site source materials and highly affected soil have been removed, a contamination reduction zone will not be required. The decontamination of equipment will take place on the decontamination

pad. The pad will be positioned at the same location used during Phase 1 and 2 of the RI. Personnel and equipment leaving the site must pass through the decontamination pad. Spent decontamination fluids will be contained in steel 55-gallon drums. Random samples will be analyzed for site constituents and propanol. Disposal of decontamination fluids will be based on the results of the analyses.

The decontamination pad will consist of an approximately 10 foot by 30 foot flexible membrane liner of either polypropylene, high density polyethylene, hypalon, or other suitable material. The area underlying the liner will be graded to drain decontamination fluids away from the equipment and to a central collection point. At this central point, decontamination fluids will be contained, sampled, and stored according to procedures described above. The pad will be used throughout these supplemental investigations and the RD/RA.

5.4 Surface Water and Sediment Sampling

5.4.1 Sample Site Selection

Selection of surface water and sediment sampling locations has been based on many factors, including: study objectives, water use, point source discharges, location and nature of tributaries, changes in stream characteristics, types of stream bed, stream depth, turbulence, presence of structures, and accessibility.

Surface water sampling sites on streams will be located in areas of the greatest cross sectional homogeneity. Since mixing is principally governed by turbulence and water velocity, the selection of a site immediately below a ripple area will promote good vertical mixing. These locations are also likely areas for sediment deposition since the greatest deposition occurs where stream velocity decreases. Horizontal (cross channel) mixing occurs in constrictions in the channel, but because of velocity increases, the stream bottom may be scoured. Therefore, a constriction is considered a poor sediment sample location. Typical sediment deposition areas are located inside of river bends, downstream of islands, and downstream of obstructions in the water.

The selection of sampling station locations include, at a minimum, the following considerations:

- time of water travel (not distance),
- marked physical changes in the stream channel,

- upstream and downstream relationships to target tributaries, discharges or investigation sites,
- point-source waste discharge or tributary lateral mixing distance,
- non-point source discharges, and
- flow patterns at the mouths of tributaries and possible mixing with main channel or lake.

Seasonal variations will also be considered since water quality and sediment depositional areas may be strongly influenced by changing flow rates. This is also an important consideration when comparisons with other investigations are anticipated.

5.4.2 Sampling Equipment and Techniques

Equipment and sampling techniques will not cause the integrity of the sample to be compromised and will provide a sample which is representative of the medium being sampled. Samples obtained from shallow flowing surface waters will be collected directly into sample containers. *The investigator will stand along the edge of the stream or wade into the water,* taking care to disturb bottom sediments as little as possible. The sample will be collected by quickly immersing the sample container with the mouth of the container pointing upstream. The sample will be collected at the mid-depth of the stream, upstream from where the investigator stands. Pre-preserved VOA vials will be collected from the stream surface. Stream samples will be collected at downstream locations first. Sample handling, labeling, records, and chain-of-custody procedures are described in Sections 4 and 6 of this FSAP.

Coring, dredging, or scooping will be used to collect a sediment sample (EPA 600/4-83-040, EPA-600/2-80-018). In each method, precautions must be taken to make the collected sample as representative of the sediment as possible. The methods described below have been included for potential use for the Medley Farm investigation and quarterly sampling program. The type of sampler method selected for the Supplemental RI is the scoop collection method. Sediment samples from shallow waters will be collected, by hand, using stainless steel scoops (EPA 600/4-83-040; EPA 600/2-80-018). The scoops will be decontaminated between each sample or clean scoops will be used for each sample. The samples will be collected upstream of the sample collector. Pebbles greater than 5-mm in diameter and vegetation will be removed

from the sample prior to filling the appropriate containers directly from the sampler. Aliquots will be composited in a decontaminated stainless steel holding vessel if a single scoop does not provide sufficient sediment volume to fill the required sample bottles. Samples for VOC analyses will not be composited. Records, labels, and chain-of-custody are maintained as described in Sections 4 and 6 of this FSAP.

5.4.3 Sampling Equipment QA Procedures

The choice of sampling equipment and techniques will be reviewed to see that the methods provide representative samples of the media being sampled and that materials and procedures are appropriate for sampling the constituents of interest to the investigation. Equipment will be inspected, tested, and, if necessary, repaired before being issued for each field investigation.

5.5 Ground Water Sampling

5.5.1 Sampling Equipment and Techniques

Four additional monitoring wells are proposed for the Supplemental field activities. Monitoring wells will be equipped with dedicated bottom-loading, closed top, Teflon® bailers. These dedicated bailers will be stored in the wells between sampling events, and will be suspended above the static water level. Dedicated bailers will be decontaminated in the field prior to their use, in accordance with Section 5.3. New nylon cord will be used to extend the bailer to the water surface during each sampling event.

The jet pump wells installed as a part of the Remedial Action will be utilized for ground water extraction only. These wells will not be used for collection of environmental samples. Wells will be purged before a sample is collected. Purge water will be discharged to the ground surface while the appropriate volume is being removed from the well.

Dedicated bailers or pumps equipped with Teflon® tubing, will be used to purge the monitoring wells. Pumps will be either peristaltic, with a vacuum jug assembly, or submersible sample pumps. A bucket of known volume will be used to measure the volume of water removed during purging. Before the wells are purged, clean, new plastic drop cloths will be spread around the wells to prevent the pumps and the ropes and hoses attached to the pumps from coming into contact with the ground surface.

Purging procedures for monitoring wells will include the following:

Step	Procedure
1.	Measure depth to water and to the bottom of the well.
2.	Calculate volume of standing water and purge at least 3 well volumes, or until the well is dry. The volume of standing water will be calculated by multiplying the volume of one-foot of well casing by the length of the column of water in the well. The volume of one-foot length of 2-inch ID casing is 0.16 gallons. For other well diameters sampled, the volume of one foot length of casing will be calculated by the formula: gallons per foot of casing = $3.14 r^2$ (feet) x 7.481 gallons where r = inside radius of the well casing in feet.
3.	Bail or pump required volume. Water will be removed from the top of the water column during purging.
4.	Measure pH, temperature, and specific electrical conductance (SEC) after each well volume is removed. Purging will be considered complete when the change in SEC between two successive well volumes is less than 10 percent or when the well has been bailed dry.
5.	Note color or turbidity changes during purging.

Ground water samples will be collected as soon as water volumes sufficient to fill the required sample bottles have flowed into the well casing.

Ground water samples for analyses other than volatile organics will be withdrawn from the well using either a Teflon® bailer, the peristaltic pump with a vacuum jug assembly or submersible sample pump and Teflon® tubing. The vacuum jug procedure is preferred for inorganics and SVOCs since it provides a sample which contains fewer suspended solids and is more representative of conditions within the aquifer. Samples for volatiles analyses will be collected using either a dedicated bailer or a submersible sample pump in order to minimize volatilization of constituents during sampling. In all cases, the VOA sample will be collected first.

Sections 4 and 6 of this FSAP describe the quality control details of sample collection container selection, labeling, and chain-of-custody. Preservation is specific to the types of analyses and the specific requirements are summarized in the QAPP.

A portion of the sample is reserved for the measurement of specific electrical conductance, temperature, and pH in the field. Section 8 of this FSAP covers equipment maintenance, calibration, and measurement procedures for these parameters. These measurements, as well as a listing of containers to be filled, physical description of samples, volumes of water purged, purging and sampling times and disposition of samples, will be recorded in the field notebooks.

5.5.2 Sampling QA Procedures

Ground water sampling procedures are designed to provide a representative sample of ground water for chemical analysis. Specific procedures for collecting ground water samples to monitor water quality are outlined below and are based on established and accepted procedures. These methods have been developed over several years and US EPA-approved procedures are used wherever applicable. Proper sampling techniques are necessary to provide representative samples that have not been altered or contaminated by the sampling procedure.

The procedures required to obtain quality samples are arranged in the order in which they are performed. The equipment and methods will vary depending on the type of wells, depth, and laboratory testing program. The QA Reviewer-Hydrogeology is responsible for reviewing procedures used in ground water sampling.

Water Level and Well Depth Measurements

Water level measurements are used to determine the hydrostatic level in monitoring wells. The depth of well measurement is used to calculate the volume of standing water in the well and to determine if the well is obstructed. These measurements will be performed before any water is removed.

An electric water level indicator will be used for water level measurements. A description of this method and other contingent water level measuring techniques is presented in Section 9.4. Total depths of wells are measured by lowering the measuring device to the bottom of the well.

Procedures for cleaning water level measuring equipment are as follows:

Step	Procedure
1.	Wash with laboratory detergent and tap water.
2.	Rinse with tap water.
3.	Rinse with deionized water.
4.	Rinse twice with pesticide grade isopropanol.
5.	Rinse thoroughly with organic-free water and allow to air dry.
6.	Equipment should be placed in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage or transit.

Field Notes

The persons who collect water samples are also responsible for taking field notes. These notes include data on the depth to water, total depth of the well, color, turbidity, time of sampling, pH, conductivity, and other pertinent data. A summary of these notes is used in the data interpretation and analysis of the laboratory results.

Field Measurements of pH, Conductivity and Temperature

The pH, conductivity, and temperature of water samples are measured in the field. The meters used in measurement will be calibrated in the field to the equipment manufacturer's specifications. Calibration procedures are described in Section 8.

Field Sampling Quality Control

Several steps are taken in the field to provide sample quality control. Some of these include the following:

- Cleaning the water level tape between wells.
- Using a dedicated bailer for sampling each well.
- Using a dropcloth at the well to protect the equipment from contact with soil around the well.
- Preparing a field blank sample consisting of organic free water which has been subjected to the same field methods as the samples.

- Field calibration of meters used for pH and conductivity.
- Replicate measurements (4) of pH and conductivity.

5.6 Ground Water Screening

The Hydrocone® sampling system will be used to collect the ground water samples. The Hydrocone® sampler will be pushed to the desired depth using In-Situ Technology's "Direct Push Technology". Before exposing the screened portion of the sampling device, the sample chamber will be pressurized with argon gas. After the screen has been exposed and a sufficient volume of ground water has been collected, the sample chamber is repressurized with argon gas. By monitoring the argon gas back-pressure, In-Situ's on-site personnel can ensure that the sample chamber is sealed before retrieving the sampling device. Once the sampler has been retrieved, the point and screen are unscrewed from the chamber. A Teflon® tube is inserted into the chamber and the sample is transferred directly into the appropriate sample containers by gravity draining.

If geologic conditions prevent the use of this sampling technology, ground water screening samples will be collected from the annulus of small diameter hollow-stem augers. After penetrating the water table, ground water will enter the inside of the augers. After a sufficient volume of water has entered the augers, the sample will be collected using a Teflon® bailer and analyzed as previously described.

Following sample collection, boreholes will be backfilled with a cement/bentonite grout slurry. Abandonment will be accomplished in accordance with the South Carolina Well Standard R-61-71.10. Equipment that may come into contact with the ground water sample will be decontaminated before and after each use according to the procedures described in Section 5.3 of this FSAP.

Ground water samples collected using In-Situ's "Direct Push Technology" will be analyzed with a Photovac model 10S70 portable gas chromatograph (GC) using a 10.6 e.v. photoionization detector. The GC will be calibrated as described in Section 8.2 of the QAPP.

Two mL of the ground water sample will be removed from a 40 mL septum vial with a syringe injected into a clean 40 mL septum vial.

After volatile organic compounds in the water sample have equilibrated with the headspace in the vial (approximately 15 minutes after sample collection), the sample will be analyzed by withdrawing an

aliquot from the vial headspace and injecting it into the field gas chromatograph. Duplicate analyses will be performed on ten-percent of the samples collected to verify the precision of the analytical technique. Instrument and syringe blanks will be performed before initial use and after samples containing a high concentration (>1 ppm) of a given analyte.

5.7 Monitoring Well Installation

5.7.1 Sample Site Selection

Monitoring wells are drilled and installed to provide hydrogeologic and ground water quality data. In selecting ground water sampling sites, the relationship of the following factors to potential sources should be considered and evaluated: direction of ground water flow, depth to water table, thickness of aquifer, stratigraphy, drainage patterns, topography, land use, nearby ground water withdrawals, and surface features such as rock outcrops, seeps, springs, streams, rivers, and wet areas. Proposed well locations are shown in the Medley Farm Site Base Map Plate 3-1. When appropriate, historical data from existing wells will be used to facilitate location of the monitoring wells. Samples of all well drilling materials, including drilling muds, bentonite pellets, grouts, sands, and potable water, will be collected during the drilling and analyzed for the presence of VOCs only.

5.7.2 Well Installation

Borings - The primary choice of drilling methods for monitoring well installation is the 10-inch continuous flight hollow stem auger method (nominal inner diameter of 7 inches). When conditions prohibit the use of hollow stem augers (i.e., excessive depth or bedrock drilling), air or mud rotary methods will be utilized (nominal inner diameter of 4 inches) (Scalf, 1981). As an alternative to air rotary drilling in bedrock, borings in bedrock may be advanced by core drillings. Core barrels will be five and/or ten feet in length and will be NQ or HQ in diameter in accordance with ASTM Method D 2113-83.

Soil and/or Rock Sampling - Soil, and rock cutting samples will at a minimum be collected at 5-foot intervals for lithologic description. If diamond core drilling is used, rock cores will be collected continuously. The samples will be used to develop a geologic log for the boring and to decide on the exact depth of well installation. The samples collected with the hollow stem auger method will be collected with split barrel samplers using the Standard Penetration Test

(ASTM-1586-84). The samplers will be decontaminated according to procedures outlined in Section 5.3 of this FSAP.

If the air rotary method is required, drill cuttings will be collected at 5 foot intervals, or at every change in lithology. The compressed air used for drilling will be filtered to remove organics and particulates. Water will be injected with the compressed air to control dust and to cool the tools.

The mud rotary drilling method may be used to install monitoring wells if downhole conditions inhibit proper installation of the well using hollow stem augers. The drilling fluid will consist of pure bentonite and potable water. Well installations requiring mud rotary will use only enough mud as required to maintain an open borehole. Split barrel samples will be collected at five-foot intervals. Wells will be developed to remove the mud from around the screen. Drilling fluids will be collected in small depressions and allowed to infiltrate into the subsurface. If the air rotary drilling method is used, a small pit will be excavated to collect drilling fluids. These fluids will then be allowed to infiltrate into the subsurface soils.

Samples collected for lithologic description will be logged by a geologist, geotechnical engineer or technician, and stored in clean, moisture-tight jars (minimum 8 oz. volume) or in sample bags as appropriate. Two jars or bags of soil will be collected whenever possible. Cores, if collected, will be labeled and stored in core boxes. Recordkeeping and labeling are described in Sections 4 and 6 of this manual.

Monitoring Well Installation - The design and depth of placement of monitoring wells must be designated to meet the specific objectives of the investigation and to be compatible with the hydrogeologic setting. Unless otherwise stated, wells installed during the Supplemental field activities will be constructed of two-inch I.D. 304 stainless steel screen and casing from the bottom to approximately ten feet above the expected static water level expected in the well. The remaining casing will be constructed of flush-threaded PVC. All PVC materials will conform to ASTM Standards D1784 and D2665. There will be no glue(s) used in the construction of the monitoring wells. If installed as a water table monitoring well, the screen will be set so that approximately two feet of its length extends above the water table surface. If installed as a bedrock well, the screen will be placed opposite the first producing fracture in competent

bedrock. Monitoring well casing and screen materials will be steam cleaned prior to installation. During transport from the decontamination area to well site, the materials will be wrapped in plastic and will remain wrapped until ready for installation.

Wells monitoring the water table surface will be constructed with a screen length of ten feet. Remaining wells will have screen lengths of five feet. On the basis of prior experience in the Piedmont, a screen slot size of 0.01 inch will be used. Screens will be machine slotted.

Annular space around the well screens will be packed with clean quartz sand. Grain size distribution is shown on Table 5-1. The sand pack will be emplaced by tremie and extend approximately two feet above the top of the screen. The top of the sand pack will be sealed via the gravity method (dropped down annular space) with bentonite pellets. Minimum thickness of the bentonite seal will be approximately two feet. Bentonite pellets will be allowed to hydrate according to the manufacturer's specifications prior to addition of grout. The remaining annular space will then be grouted from the bentonite seal to approximately two feet below the land surface, from the bottom up using a cement bentonite grout slurry placed with a tremmie pipe. The ratio of water:cement:bentonite will be approximately 3:6:1. A three-foot by three-foot by six-inch concrete pad will be framed and poured around each well. The concrete pad will extend six inches below the land surface within six inches of the borehole. A steel protective cover will be placed over each well and secured in grout column and/or concrete. Weep holes will be drilled through the protective cover above the concrete pad. Each well will be lockable. Typical well construction diagram is included on Figure 5-1.

To address EPA concerns for hydration of the bentonite pellets, RMT will utilize Volclay grout in place of the cement-bentonite slurry more typically used. Volclay grout will be mixed according to manufacturer's specifications and pumped, via a rigid tremmie, from the bentonite seal above the sand pack to approximately two feet below land surface. The bentonite seal will be allowed to hydrate during the time necessary to mix the Volclay grout. The characteristics of Volclay grout permit continued hydration of the bentonite seal, without the need for leaving a borehole open for eight hours.

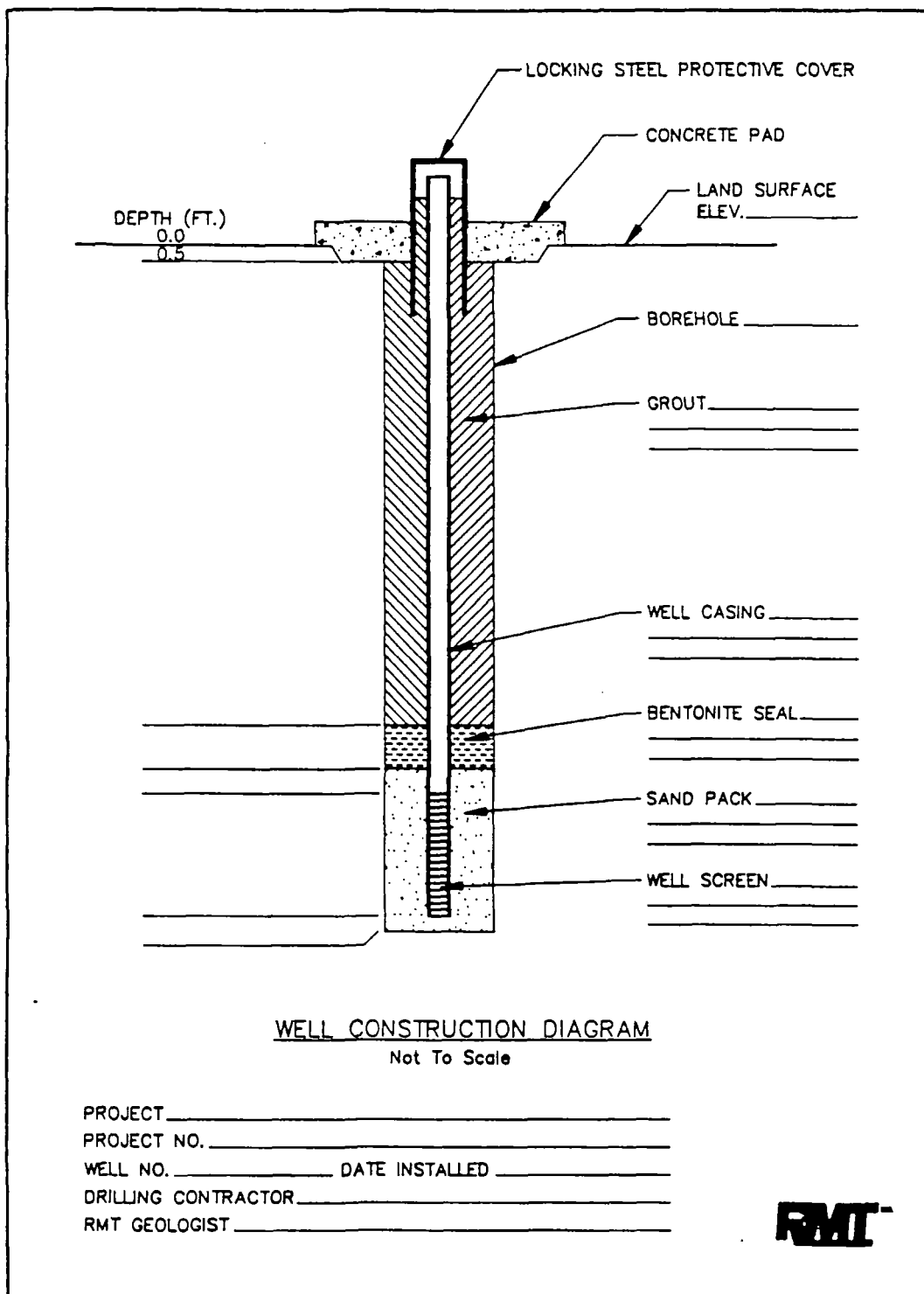
TABLE 5-1
GRAIN SIZE ANALYSIS OF SAND FOR PACKING WELL SCREENS

US Mesh	Grams Retained	Percent Retained Cumulative	Percent Retained Per Sieve
6	0.00	0.00	0.00
8	0.00	0.00	0.00
10	0.00	0.00	0.00
12	0.00	0.00	0.00
14	0.00	0.00	0.00
16	0.40	0.72	0.72
18	5.90	6.98	6.26
20	15.40	25.97	16.99
25	27.10	48.48	24.51
30	42.30	75.67	27.19
35	52.90	94.63	18.96
40	55.20	98.75	4.11
45	55.60	99.46	0.72
50	55.70	99.64	0.18
70	55.80	99.82	0.18
PAN	55.90	100.0	0.18

Effective Size:
Uniformity Coefficient:
sand

0.524 mm
1.446

Figure 5-1 Typical Well Construction Diagram



Documentation of well installation is not dependent on the well design. Field notes will record: the materials used in construction; length of well screen and casing installed; depth of surface casing if used; depth of borehole; diameter of borehole; depth to the bottom of the well; height of well casing above ground; depth, type, and thickness of sand pack, seals and backfill materials; methods used to place seals and backfill materials; depth to water table; and any other factors or problems associated with monitoring well installation.

Wells monitoring the shallow water table will be developed by pumping (PVC positive displacement) or bailing (PVC bailer) until discharge is sediment-free, or the change in specific conductance and temperature between two successive well volumes is less than 10 percent. If deeper saprolite monitoring wells or bedrock wells are installed, development will be accomplished by air lift or submersible pump. The air will be double filtered and cooled. A surge block will be available, if needed. Specific pumping rates will depend on well yield. Wells that are pumped dry during development will be allowed to fully recharge and will be pumped again. Ground water removed during well drilling and development will be collected in shallow excavations near the drilling location and allowed to infiltrate back into the subsurface. Development water (along with purge water and drilling fluid) obtained from a particular well will also be collected in shallow excavations and allowed to infiltrate into the subsurface.

Well abandonment, if required, will be accomplished in accordance with the abandonment procedures described in the State of South Carolina Well Standards and Regulations, R.61-71.

Section 6

SAMPLE HANDLING AND ANALYSIS

This section presents general sample handling and analysis methods. Additional information is contained in the QAPP.

6.1 Sample Containers and Shipping

Sample containers, preservation methods and holding times that meet EPA standards will be used. New containers will be used. Water samples for volatile organic analyses will be acidified prior to sample collection. Samples will be checked for pH in the field and when they arrive in the laboratory. Additional preservatives will be added if the pH requirements for preservation are not met. These procedures will be documented on the chain-of-custody form for the samples.

Sample container requirements of solid and liquid samples intended for chemical analyses are summarized in the QAPP. Samples collected from different media that are intended for organic analyses will be collected in the appropriate container. The sample container will be filled completely to minimize air space. Soil samples intended only for physical testing (e.g. grain size) will be placed in clean glass jars (minimum 8 oz. volume). Two jars will be filled from each sample whenever sufficient sample volumes are available.

For delivery of samples to the laboratory, the following procedure will be implemented:

Step	Procedure
1.	Collect, preserve and seal the samples as outlined in this FSAP.
2.	Place sample containers in laboratory shipping container(s). Samples will be sealed inside ziplock containers and double-wrapped with bubble wrap to protect the containers from accidental breakage during shipment and so that the samples do not leak or spill.
3.	If samples must be chilled, either blue ice or watertight bags supplied by the lab will be filled with enough ice to last the trip. In cases where natural ice is used, RMT will place the sealed bags on the sample bottles. This step will prevent leakage of the ice as it thaws.

Step	Procedure
4.	Complete the chain-of-custody forms as described in Section 4.2 of the FSAP.
5.	Tape chain-of-custody form to the inside of the shipping container lid.
6.	Seal shipping container.
7.	Deliver or ship to the laboratory. Fastest available shipping methods will be used whenever required by short holding times or project schedules.

Responsibility for proper use of containers and preservatives is the duty of the On-Site Coordinator and the Project Laboratory Coordinator.

6.2 Selection of Parameters

The list of parameters has been provided in Section 3 of this FSAP. The number and locations of samples are also specified in Section 3 of the FSAP.

6.3 Analytical Procedures

The selection of analytical procedures will reflect US EPA-approved methodology from the CLP program, where applicable, as stated in the QAPP.

Section 7

FLOW MEASUREMENT

The measurement of surface water flow may be necessary during the supplemental field investigation or remedial design. Measurement of water flow should be given as much attention and care as collection of samples and their subsequent laboratory analysis. Specific flow measurement techniques are presented in the following portions of this section.

- **Bucket and Stop Watch** - The bucket and stop watch technique is particularly effective for the measurement of small flows. The equipment required to make this measurement is a calibrated container (bucket, drum, tank, etc.), a stop watch, and a wier. Three consecutive measurements should be made, and the results should be averaged.
- **Velocity-Area Method** - This method is based on the concept that the flow in a channel is equal to the average velocity times the cross-sectional area of the channel. The velocity of the water is determined with a current meter; the area of the channel is calculated by using an approximation technique in conjunction with a series of velocity measurements. The United States Geological Survey (USGS) mid-section method and the stream gaging techniques described in the publication, "Discharge Measurements at Gaging Stations" (USGS, 1965) will be the standard practice. Meters will be examined before and after each discharge measurement. The examination will include the meter cups or vanes, pivot and bearing, and shaft for damage, wear or faulty alignment. Meter balance and alignment will be checked prior to each use in the field (9). Meters will be cleaned and oiled daily when in use. Surfaces that will be cleaned and oiled on a yearly basis are the pivot bearing, pentagear teeth and shaft, cylindrical shaft bearing, and thrust bearing at the cap.

Section 8 FIELD ANALYTICAL TECHNIQUES

With any field analytical measurement, the equipment used must be suitable for the analytical method to be made and properly calibrated. In addition to being accurate, field analysis must be conducted on a sample representative of the source from which it was collected. Therefore, the type of sample and location of the sampling site are critical. A detailed discussion of sample type and sample site selection is given in Section 3 of this FSAP.

Specific field analytical techniques to be utilized are presented in this section and the QA procedures for each analytical technique and field test are presented in Appendix A. Field analyses described below will be performed on all water samples collected.

8.1 Measurement of pH

pH measurements will be made electrometrically using a glass combination electrode and portable pH meter. Portable Orion Research Ionanalyzer Model 399 meters with provisions for temperature compensation will be used. Combination electrodes will be used in conjunction with the meters. The pH calibration and measurement procedures are as follows:

- Turn function switch to pH position.
- Select two buffers, the first with a pH of 7. Select a second buffer so that the two buffers bracket the anticipated sample pH.
- Place combination electrode in pH 7 buffer solution.
- Turn the calibration control until the needle points to the pH value of the buffer.
- Remove electrodes from the pH 7 solution. Rinse with distilled water and place in the second buffer solution.
- Turn the temperature compensator knob until the meter needle points to the pH value of the second buffer solution.
- Turn the slope indicator until the arrow of the temperature compensator points to the temperature of the solution. The percent of theoretical slope can be read on the slope scale. A slope of less than 90 percent may be caused by a defective pH electrode or a contaminated buffer solution.
- Remove electrodes from the second buffer solution, rinse with distilled water, and place in unknown solution. Read the pH value of the unknown on the pH scale.

The meter will be checked for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes before mobilizing for field activities.. The meter and electrode will also be calibrated against standard buffer solutions of known pH values (e.g., pH-4, pH-7, and pH-10). While in the field, the meter will be calibrated several times per day with the buffers. In case of an apparent discrepancy in a pH measurement, the electrode will be checked with pH 7.0 buffer and recalibrated to the closest reference buffer. Then the sample will be reanalyzed. Duplicate analyses will agree within 0.2 pH units. The buffer solution containers will be refilled each day from fresh stock solution.

A log book will be maintained and will contain the property number of each pH meter. Calibrations and repairs will be noted in the log book indicating the date, repairs made, person making repairs, calibration records, and time used in the field for each meter. The pH will be reported to the nearest 0.1 pH unit.

8.2 Measurement of Conductivity

A YSI Model 33 set meter will be used to measure specific conductance. Each meter will be checked before mobilizing for field work. Batteries will be checked, and conductivity cells will be cleaned and checked against known standards. Procedures for checking calibration and making field measurements are as follows:

- With the instrument turned off, adjust scale to zero by turning the bakelite screw on the face of the meter so that the needle coincides with zero on the conductivity scale.
- Calibrate the meter by turning the mode control to red line and adjusting the red line control so the meter needle lines up with the red line on the meter face.
- Plug the probe into the probe jack.
- Put probe in solution to be measured.
- Switch mode control to the X100 scale. If reading is below 50 on 0-500 range, switch to the X10 scale. If the reading is still below 50, switch to the X1 scale. Read the meter scale and multiply the reading appropriately. The meter output is expressed in umhos/cm.

Specific conductance will be corrected to 25°C by using the formula:

$$SC\ 25^{\circ}C = SCF [1+(25^{\circ}-TF)0.02]$$

where SC 25°C = Specific conductance at 25°C

SCF = Specific conductance recorded in field

TF = Temperature recorded in field in degrees celsius.

Duplicate field analyses should agree within ± 15 percent.

A log book will be maintained with all specific conductance meter property numbers. All repairs, calibrations and field time usage will be noted. The log book will include dates, repairs made and person making repair.

Results will be expressed in micromhos/centimeter (umhos/cm) corrected to 25°C. Results will be reported to the nearest ten units. Field book entries will also specify the meter reading at sample temperature.

8.3 Measurement of Temperature

Thermometers will be initially calibrated against a National Bureau of Standards (NBS) certified thermometer. Thermometers will be inspected before each field trip to see that it is not cracked and that there are no air spaces or bubbles in the mercury. If a dial thermometer is used, it will be checked to be sure that it does not have a broken face cover or otherwise show damage. A cross-check with a calibrated NBS certified thermometer will be made semi-annually. Before using a thermometer in the field, field personnel will make a visual observation to see that it has not been damaged. Cross-checks and duplicate field analysis will agree to within $\pm 0.5^\circ\text{C}$.

A log book will be maintained with each thermometer property number recorded. Calibration information, individuals making the calibrations, and dates will be recorded. Field calibrations will be noted in the field notebooks indicating the temperature readings observed. All data will be reported to the nearest 1°C .

Section 9

FIELD PHYSICAL MEASUREMENTS

Field measurements of topographic features, water levels, and physical measurements are frequently required on field investigations. The scope of such measurements depends upon the purpose of the particular investigation.

Physical measurements should be traceable to the actual person making the measurement and to the actual piece of field equipment used to make that measurement. Equipment maintenance and calibration records will be kept in log books and field records, making all such procedures traceable. Time records will be kept using local time in the 2400 hour military format, recorded to the nearest five minutes.

Sampling locations (surface water, sediments, borings, wells, surface soil, etc.) utilized during the field investigations will be surveyed and depicted on a scaled drawing, topographic or other standard map, or be referenced in such a manner that their location(s) are firmly established. The topographic base map for the Medley Farm site was compiled from an April 7, 1988 aerial survey conducted by Bell Mapping Company of Winston-Salem, North Carolina. Surveying will be conducted according to procedures described below and in McCormac (1976).

9.1 Site Mapping

Accurate, complete, and informative field notes in surveying is a primary objective in site mapping. The quality of the final output is a reflection of the field record. The field notes are the only reliable record of measurements made and information gathered in the field. Information gathered will be recorded in the field on bound field notebooks. Notes will be permanent, legible, and complete.

Field notes will be recorded in the field with a waterproof ink pen. Records will not be made on scratch paper and copied later, or based on other information recorded from memory. Also, mistakes in field notes will be crossed out, initialed, and dated. Notes recorded during site mapping will follow the guidelines presented in Section 4.3.

The field notes will accomplish the following:

- Provide adequate and complete information which can be understood by someone other than the note-taker.
- Provide professional documentation of work done or data gathered.

The surveyor is encouraged to use notebook space liberally in recording necessary data. Explanatory remarks are encouraged to clarify the field procedures and provide added details. Field sketches are also very useful and should be used freely. Two important aspects of each survey to be addressed in the field notes include:

- **Starting and Ending Basis of the Survey** - The surveyor will explain and document the starting and ending points of his survey. This applies to both the horizontal and vertical controls. This will require a paragraph of explanation and sketches and/or cross references to data in notes of previous surveys.
- **Clear Indication of Final Results and Checking Procedures** - The final results and checks will be plainly indicated. Erasures shall not be used as they raise uncertainties about the reliability of the data. Alterations, additions, revisions, reductions, or comments added to field notes should be written in colored ink or pencil (usually red) to indicate that such information is not part of the original field record. The person making such notations will initial and date each page so affected.

A checklist of information to include in the field notes follows:

- Date.
- Names of crew members.
- Condition of weather, observed temperatures, relative wind speed, and barometric pressure if an EDM is to be used.
- Equipment used, listing the serial number or other identification.
- Location of survey by section description or other legal parcel identification.
- Project and element number.
- North arrow.
- Description of all monuments found.

- Measurements as made (slope distance and vertical angles, temperature, taping, horizontal angles, etc.)
- Corrected distances and angles.
- Description of monuments set.
- Relation of possession or encroachments to survey lines.
- Outline or sketch of major traverse or property boundary.

9.2 Ground Elevation Surveys (Vertical Control)

The elevation of the measuring point of wells and a reference point on staff gages will be surveyed to allow correlation of water levels. Additionally, ground elevations may be required for topographic purposes. Standard engineering leveling techniques, as described in basic surveying textbooks, establish the methodology for providing vertical control. The datum referenced for elevation control is the National Geodetic Vertical Datum (NGVD), informally known as 1929 sea level datum, established by the U.S. Coast and Geodetic Survey. Bench marks of known elevation should be used. If no bench mark is located in the vicinity of a site investigation, an arbitrary temporary bench mark should be established on a permanent location (i.e., bridge wingwall, foundation, or corner post). The location of bench marks utilized shall be shown on the site sketch map. Elevation surveys will be conducted to form a circuit; for example, the survey line should close back to a bench mark. Third order accuracy should be obtained on level circuits; for example, on a one-mile circuit, the closure should be within 0.05 foot. Length of sight will not ordinarily exceed 250 feet, with turning point back shots and fore shots deviating no more than 50 feet from one another.

9.3 Surface Water Stage

Surface water stage will be measured on standard staff gages graduated to 0.01 foot. The staff gage will be firmly anchored in the bed of the river, stream, or lake. Staff gages will be surveyed and referenced to NGVD. Measurements of water stage will be noted in field logs along with date, time, and site location. Water stage will be recorded to the nearest 0.01 foot.

9.4 Ground Water Level Measurement

The measurement of ground water level in wells is typically conducted in conjunction with ground water sampling. Data from such measurements is needed to establish ground water gradients, and ultimately, the direction of ground water flow.

Ground water level measurements are made in reference to an established reference point on the well casing. This reference point will be documented in field records. Reference points will be tied in with the NGVD (Mean Sea Level, MSL) or a local datum. Local datum could be used for an isolated group of wells that will not be combined in analyses of regional hydrogeology. Ground water level measurements will be made and recorded to the nearest 0.01 foot. The calculated elevations will be reported to the nearest 0.01 foot. The water level indicator will be decontaminated between wells by rinsing with deionized water, twice rinsing with propanol, rinsing with deionized water, and air drying.

9.4.1 Specific Ground Water Level Measuring Techniques

Measuring the depth to the ground water table can be accomplished by the following methods:

- **Electric Water Level Indicators** - This method consists of a spool of small diameter insulated steel cable with a probe attached to the end. When the probe comes in contact with the water, the circuit is closed and a meter, light, and/or buzzer attached to the spool signals the contact. Penlight batteries are normally used for a power source. Depth to water is read from permanent marks on the cable to which the probe is attached. Depth is recorded to the nearest 0.01 foot by measuring the distance between the nearest permanent foot mark and the point where the meter indicated the water level.
- **Chalked Tape** - The end of a weighted tape will be chalked and lowered into the well while recording the amount of tape lowered. The tape will be retrieved from the well and the wet chalked area will be subtracted from the total measurement.
- **Popper or Bell Sounder** - A bell or cup shaped weight that is concave on the bottom will be attached to a measuring tape and lowered into the well. A "plopping" or "popping" sound is made when the weight strikes the surface of the water. An accurate reading will be determined by lifting and lowering the weight in short strokes, and reading the tape when the weight barely strikes the water.
- **Weighted Tape** - This method is the same as the "bell sounder" except that a steel weight is fastened to the end of the tape measure.
- **Other Methods** - Other types of water level indicators and recorders are available on the market such as the sliding float method, air line pressure method, and electrical and automatic recording methods. These methods are primarily used for closed systems or permanent monitoring wells.

9.4.2 Specific Quality Control Procedures

Ground water level measuring devices will be calibrated to 0.01 foot accuracy once yearly.

Before use, these devices are prepared according to the manufacturer's instructions (if appropriate) and checked for obvious damage.

Section 10

HEALTH AND SAFETY MONITORING

Health and safety monitoring will be carried out as described in the site specific Health and Safety Plan in compliance with OSHA Occupational Safety and Health Standards 29 CFR Part 1910. This Plan includes, but is not limited to:

- site characterization and analysis,
- site control,
- training,
- medical surveillance,
- engineering controls,
- monitoring,
- material handling programs,
- decontamination procedures, and
- emergency response procedures.

This health and safety program is presented in the RMT Health and Safety Policy. In accordance with this program and OSHA 29 CFR 1910.120, the Medley Farm project site had a site-specific, detailed Health and Safety Plan prepared. Specific requirements for activities on the Medley Farm site are outlined in the Health and Safety Plan.

10.1 Organic Vapor Monitoring

Organic vapor monitoring will be conducted with portable direct reading field equipment. If necessary, air samples will be collected in adsorbent tubes for laboratory analyses to determine the composition

and concentration of vapors and gases. Procedures for collecting air sampling data are outlined in the following narrative.

Century Systems Portable Organic Vapor Analyzer Model OVA-128 (OVA)

- Follow start-up procedures and calibrate unit (operator manuals will be kept with the instrument). The unit startup and calibration procedures are outlined in Appendix A.
- Conduct survey with instrument in survey mode at areas of potential concern.
- Periodically monitor meter to identify any increase in concentration of organic vapor.
- Consult Site Health and Safety Plan for response to organic vapor concentrations detected above background levels.
- Use laboratory grade hydrogen gas to refill the unit as necessary.
- Malfunctions detected with this piece of equipment should be reported to the On-Site Coordinator who will take appropriate action to correct the situation.

HNu Systems, Inc. Model P1 101 portable Photoionization Analyzer with 10.8 EV probe.

- Follow start-up procedures and calibrate unit according to instructions included in Appendix A.
- Conduct site survey in areas of concern.
- Consult Health and Safety Plan for guidance on response to organic vapor levels detected above background.
- Periodically monitor meter to identify any increase in concentration of organic vapors.
- Malfunctions detected with this piece of equipment should be reported to the On-Site Coordinator, who will take action to correct the situation.

Sampling activities or activities being conducted in areas that are suspected to contain hazardous substances require regular air monitoring to indicate if the site activities are causing excessive concentrations of airborne constituents. The background concentration of organic vapors will be determined in an area free of influences from organic vapor sources. The OVA or HNu instrument will be used to measure organic vapor concentrations where the sampling activities are being conducted. The instrument will sample air at the breathing zone level (3 to 6 feet above ground level) at the sampling location. The immediate area will be evacuated and personal protection levels will be evaluated if organic vapor concentrations attain or exceed action levels established in the site specific Health and Safety Plan. Additional air sampling may be required to characterize the types and

concentrations of air constituents responsible for the OVA/HNu readings if the source of contamination and the substances likely to be present cannot be readily and reliably identified. The On-Site Coordinator will be responsible for:

- Set up and calibration of the unit.
- Periodic observation of the unit to take readings and ensure that it is functioning properly.

Air monitoring data will be turned over to the site Health and Safety Officer at the end of each day. If a strip chart recorder is used, the strip chart for each monitoring station will be labeled with the location, time, date, type of activity monitored and instrument operator's name.

10.2 Explosimeter

When either OVA or HNu readings exceed 50 ppm, an explosimeter will be used to determine the percent LEL (lower explosive limit) of combustible gases and vapors. The procedures to be followed include:

- Set up and calibrate units according to procedures described in Appendix A.
- Refer to Health and Safety Plan if levels above background are detected.
- Malfunctions detected with this piece of equipment should be reported to the On-Site Coordinator who will take action to correct the situation.

Section 11

DATA REDUCTION, VALIDATION, AND REPORTING

This section establishes the procedure for data reduction, validation, and reporting for field and laboratory measurements. Established techniques will be employed for data reduction and validation. The method used for data reduction and validation will be documented for each technique. Where possible, written procedures or instructions will accompany the data or be specifically cited. The Quality Assurance Reviewers will be responsible for determining that data reduction, validation, and reporting methods follow the approved procedures. The reviewers will see that corrective actions are implemented, as needed.

11.1 Water Level Measurements

Water level measurements made during the course of the project will be transferred from the field notebooks to a summary sheet. Water level elevation will be determined by subtracting the depth to water from the surveyed elevation of the well head reference point. Water levels will be measured within a period of 36 hours to allow correlation. The Field Technician will validate each round of water level measurements by comparing it to previous data and to water level values from surrounding monitoring wells that are completed in the same hydrostratigraphic unit. If there are substantial changes, the water level measurement will be repeated. If the data cannot be remeasured, the On-Site Coordinator is responsible for determining if an error was made in recording the depth to water, or in surveying the elevation of the reference point of the top of the well. If necessary, monitoring wells with a consistent history of questionable water levels will be re-surveyed.

11.2 Industrial Hygiene

The Site Safety Officer or his designee will be responsible for recording and reducing the air monitoring data. Data will be validated by the Site Safety Officer in a timely manner to minimize the risk to the health and safety of on-site workers. Action required in response to the data will be coordinated with the Health and Safety Director and the Project Manager. The Quality Assurance Reviewer-Health and Safety will provide Quality Assurance surveillance of the Site Health and Safety Plan.

Air monitoring instruments will be used on-site to document the air quality and form the basis for changing the level of protection required by on-site staff. The data will be incorporated in the project files and summarized in progress reports by the Site Safety Officer.

11.3 Laboratory

Analytical data produced during site investigation will be reduced, validated, and reported using the procedures found in the QAPP.

Section 12

REFERENCES

1. McCormac, 1976. Surveying, Prentice-Hall, Inc.
2. Scaf, et al. 1981. Manual of Ground Water Sampling Procedures. National Water Well Assoc., Columbus, OH.
3. USEPA, 1980. Samples and Sampling Procedures for Hazardous Waste Streams, United States Environmental Protection Agency, Municipal Environmental Research Laboratory, EPA-600/2-80-018.
4. USEPA, 1983. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods. EPA 600/4-83-040. Environ. Moni. Sys. Lab., Las Vegas, NV.
5. USGS, 1965. "Discharge Measurements at Gaging Stations," Hydraulic Measurement and Computation, Book I, Chapter 11, United States Department of Interior, Geological Survey.
6. Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. EPA Region IV, Environmental Services Division, February 1, 1991.

U . S . E P A R E G I O N I V

SDMS

Unscannable Material Target Sheet

DocID: 4308 Site ID: SCD980558142

Site Name: Medley Farms Box 6 of 13

Nature of Material:

Map:



Photos:

Blueprints:

Slides:

Computer Disks:

CD-ROM:

Oversized Report:

Log Book:

Other (describe):

Amount of material: 1 MAP SUPP. SITE INVESTIGATION Program

Please contact the appropriate Records Center to view the material.

APPENDIX A
QA PROCEDURES FOR FIELD EQUIPMENT

A.1 Calibration of Field Equipment

A.1.1 Specific Conductance -Temperature Probe

This instrument is checked for accuracy by using a potassium chloride solution of known specific conductance and a reference thermometer. The check is performed daily and the readings must agree to 5 percent of the correct values. Four replicate measurements are made and averaged to ensure precision. Specific instrument procedures are found in the operator's manual.

A.1.2 pH Meter

The field pH meters are calibrated frequently throughout the day with three buffer solutions (pH 4, 7, and 10). The instrument is calibrated on two points, usually 4 and 7, and then the pH 10 buffer is read. Slope stability of the pH probe must be 90-100%. Specific instrument procedures are found in the operator's manual.

A.1.3 Organic Vapor Analyzer

The OVA will be calibrated three times, at the start and end of each day's use, and at mid-day, as follows:

Gain Adjustment

- a) Place instrument in normal operation with CALIBRATE Switch set to X10 and GAS SELECT control set to 300.
- b) Use the CALIBRATE ADJUST (zero) Knob and adjust the meter reading to zero.
- c) Introduce a methane sample of a known concentration (near to 100 ppm) and adjust trimpot R-32 on circuit board so that meter reads equivalent to the known sample.
- d) This sets the instrument gain for methane with the panel mounted gain adjustment (GAS SELECT) set at a reference number of 300.
- e) Turn off H2 SUPPLY VALVE to put out flame.

Bias Adjustment

- a) Leave CALIBRATE Switch on X10 position and use CALIBRATE ADJUST (zero) Knob to adjust meter reading to 4 ppm.
- b) Place CALIBRATE Switch in X1 position again. Use CALIBRATE ADJUST (zero) Knob to adjust meter to a reading of 40 ppm.
- d) Move CALIBRATE Switch to X100 position and use trimpot R-33 on circuit board to adjust meter reading to 40 ppm.

- e) Move CALIBRATE Switch to X10 position and use CALIBRATE ADJUST (zero) Knob to adjust meter reading to zero.
- f) Unit is now balanced from range to range, calibrated to methane, and ready to be placed in normal service.

A.1.4 HNu Model PI-101 Portable Photoionization Analyzer

The HNu will be calibrated at the start and end of each day's use using the calibration gas supplied by the manufacturers and according to the following procedure:

- Identify the probe by the lamp label.
- Connect the probe to the readout assembly.
- Set the SPAN pot to the proper value for the probe being calibrated.
- Check the Ionization Potential (IP) of the calibration gas to be used. The IP of the calibration gas must be at or below the IP of the lamp.
- Proceed with the calibration. Check the calibration memo for specific data.
- Battery check - Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.
- Zero set - Turn the function switch to STANDBY. In this position the lamp is OFF and no signal is generated. Set the zero point with the ZERO set control.
- 0-20 or 0-200 range - For calibrating on the 0-20 or 0-200 range only one gas standard is required. Turn the function switch to the range position and note the meter reading. Adjust the SPAN control setting as required to read the ppm concentration of the standard. Recheck the zero setting. This gives a two-point calibration; zero and the gas standard point. Additional calibration points can be generated by dilution of the standard with zero air if desired.
- 0-2000 range - For calibrating on the 0-2000 range, use of two standards is recommended. First calibrate with the higher standard using the SPAN control for setting. Then calibrate with the lower standard using the ZERO adjustment. Repeat these several times to ensure that a good calibration is obtained. The analyzer will be approximately linear to better than 600 ppm. If the analyzer is subsequently to be used on the 0-20 or 0-200 range, it must be recalibrated.
- Lamp cleaning - If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned.
- Lamp replacement - If the lamp output is too low or if the lamp has failed, it must be replaced.

Rapid calibration checking in the field can be accomplished by use of a small disposable cylinder containing isobutylene. Immediately after a calibration has been completed, a reading

is taken on a special isobutylene standard. This provides a reference concentration measurement for later checking in the field. This can be done at any time with a portable cylinder containing this same special standard, using this reference reading as a check, and making adjustments to the analyzer if necessary. In effect, this is an indirect method of calibration, one maintaining the calibration to give direct readings for the original gas mixture, but using the portable isobutylene cylinder. Details are given in Section 8.2 of the Appendix.

A.1.5 Personal Air Pumps

A precision Rotometer will be used as the secondary calibration device and will be calibrated no less than once per month against a bubble meter (the primary standard).

A.1.6 Explosimeter and Oxygen Detector

Portable Combustible Gas Indicator Johnson Instruments Model GP-204. The GP-204 will be calibrated using the calibration Potentiometer. This adjustment is used to set the meter reading to the desired level, while sampling a known concentration of combustible gas. In the GP-204, the top plate must be removed by taking out the screws in each corner. The calibration potentiometer is a slotted-shaft control located on the upper right hand corner of the meter. Turn clockwise to increase meter reading.

A.2 Specific Equipment Startup and Use Procedures

A.2.1 Organic Vapor Analyzer

The GAS SELECT control should be turned to the desired dial setting prior to being turned on. The procedure for determining this setting is contained in Section 4 of this manual. The instrument, as received from the factory, is set to measure in terms of methane in air.

- a) Move the INSTR Switch to ON and allow five minutes for warm up.
- b) To set the audible alarm to a predetermined level, first turn the PUMP Switch to ON, then adjust the meter pointer to the desired alarm level, using the CALIBRATE ADJUST (zero) Knob. Turn the Alarm Level Adjust Knob on the back of the Readout Assembly until the audible alarm just comes on. Adjust speaker volume with VOLUME Knob. If earphone is used, plug in and readjust the volume as desired. The instrument is then preset to activate the alarm when the level exceeds that of the setting.
- c) Move the CALIBRATE Switch to X10 and adjust the meter reading to zero with the CALIBRATE ADJUST (zero) Knob.
- d) Ensure the PUMP Switch is ON and observe the SAMPLE FLOW RATE Indicator. Indication should be approximately 2 units.
- e) Open H2 TANK VALVE one (1) turn and observe the reading on the H2 TANK PRESSURE Indicator. (Approximately 150 psi of pressure is needed for each hour of operation).

- f) Open H2 SUPPLY VALVE 1/2 to 1 turn and observe the reading on the H2 SUPPLY PRESSURE Indicator.

CAUTION

Do not leave H2 SUPPLY VALVE open when the pump is not running, as this will allow hydrogen to accumulate in the detector chamber.

- g) Confirm that meter is still reading zero (readjust if required).
- h) Depress igniter button. There will be a slight "pop" as the hydrogen ignites and the meter pointer will move upscale of zero. Immediately after ignition, release the igniter button. Do not depress igniter button for more than 6 seconds. If burner does not ignite, let instrument run for several minutes and try again. After ignition, the meter pointer will indicate the background concentration. This background level is nulled out using the CALIBRATE ADJUST (zero) Knob.

NOTE

Since the OVA utilizes the sample air drawn by the pump into the detector chamber as the only source of air to support the hydrogen flame, without adjustment the instrument will read the actual background concentration (ppm) of all hydrocarbons present at a given location.

- i) Move instrument to an area which is representative of the "lowest ambient background concentration" (cleanest air) to be surveyed. Move the CALIBRATE Switch to X1 and adjust the meter to read 1 ppm with the CALIBRATE ADJUST (zero) Knob.

NOTE

Adjustment to 1 ppm (rather than 0) is necessary in the X1 range because of the sensitivity of the OVA. This permits minor downward fluctuations in the normal background level without dropping below 0, which would actuate the flame-out alarm. It is important, therefore, to remember during the subsequent survey that 1 ppm must be subtracted from all readings. Therefore, a 1.8 ppm reading would actually be only 0.8 ppm.

- j) If the alarm level is to be set above the normal background detection level, turn the Alarm Level Adjust Knob on the back of the Readout Assembly until it actuates slightly above background.

THE INSTRUMENT IS NOW READY FOR USE.

OPERATING PROCEDURES

- a) Set the CALIBRATE Switch to the desired range. Using one hand operation, survey the areas of interest while observing the meter and/or listening for the audible alarm indication. For ease of operation, carry the Side Pack Assembly positioned on the side opposite the hand which holds the Probe/Readout Assembly. For broad surveys

outdoors, the pickup fixture should be positioned several feet above ground level. When making quantitative reading or pinpointing, the pickup fixture should be positioned at the point of interest.

- b) When organic vapors are detected, the meter pointer will move upscale and the audible alarm will sound when the present point is exceeded. The frequency of the audible alarm will increase as the detection level increases.
- c) If the flame-out alarm is actuated, ensure that the pump is running, then press the igniter button. Under normal conditions, flame-out results from sampling a gas mixture that is above the lower explosive level which causes the H₂ flame to extinguish. If this is the case, reignition is all that is required.
Another possible cause for flame-out would be restriction of the sample flow line which would not allow sufficient air into the chamber to support combustion of the H₂ flame. The normal cause for such restriction would be a clogged particle filter or other restriction in the line. It should be noted that the chamber exhaust port is on the bottom of the case and blocking this port with the hand will cause fluctuations and/or flame-out.

A.2.2 HNu Model PI-101 Portable Photoionization Analyzer

The following procedures are to be used in operating the analyzer:

- a) Unclamp the cover from the main readout assembly.
- b) Remove the inner lid from the cover by pulling out the two fasteners.
- c) Remove the probe, handle and cable from the cover. Attach the handle to the front part of the probe.
- d) Connect the probe cable plug to the 12 pin keyed socket on the readout assembly panel. Carefully match the alignment slot in the plug to the key in the connector. Screw down the probe connector until a distinct snap and lock is felt.
- e) Screw the probe extension into the probe end cap. The probe may be used without the extension if desired.
- f) Set the SPAN control for the probe being used (10.2, 9.5, or 11.7 eV) as specified by the initial factory calibration or by subsequent calibrations.
- g) Turn the function switch to the BATT (battery check) position. The needle on the meter will go to the green zone if the battery is fully charged. If the needle is below the green arc or if the Low Battery Indicator comes on, the battery must be recharged before the analyzer is used.
- h) Set SPAN pot to the desired value based on the gas to be used.
- i) Turn the function switch to the STANDBY position. Turn the zero adjustment until the meter needle is at zero.

- j) Calibrate the instrument daily as described in Section B.1.4. Calibration on the selected operating range is desirable.
- k) If equipped with optional alarm, set or check the alarm setting at the level desired. Turn the function switch to the desired range, turn the zero adjustment control so the meter needle moves upscale through the desired value. This simulates real conditions. Observe the reading when the alarm sounds. Adjust the ALARM SET, if required, with a screw driver. Turn the function switch to the STANDBY position and reset the zero position (par. h. above). If the range is to be changed, the alarm must be reset on that range.
- l) To operate with optional recorder, add the recorder bracket. Remove the plug in the analyzer case and insert power cord into the recorder. Then connect the signal leads to the appropriate jacks in the control module. The recorder is now operational.

NOTE: Ranges must be marked on the chart as the recorder prints the meter display as % of Full Scale.

- m) Turn the function switch to the appropriate operating position. Start with the 0-2000 position and then switch to the more sensitive ranges. The UV light source should be on, confirmed by briefly looking into the probe to observe a purple glow from the lamp.

Do not look at the light source closer than 6 inches with unprotected eyes. Observe only if necessary, then only briefly. Continued exposure to ultraviolet energy generated by the light source can be harmful to eyesight.
- n) The analyzer is now operational.
- o) Hold the probe so that the extension is at the point where the measurement is to be made. The instrument measures the concentration by drawing the gas in at the end of the extension, through the ionization chamber, and out the handle end of the probe. The instrument measures gases in the vicinity of the operator and a high reading when measuring toxic or explosive gases should be cause of action for operator safety.
- p) Take the reading or readings as desired taking into account that air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings. Change the ranges as required.
- q) Check battery condition as required. If the Low Battery Indicator comes on, turn analyzer off and recharge. Use only in an emergency with a lower battery when on battery charge.
- r) After completion of use, check battery condition as described in para. g.
- s) Turn function switch to OFF position.
- t) When not operating, leave analyzer in assembled condition, and connected to battery charger.

- u) When transporting, disassemble probe and extension from readout assembly and return equipment to its stored condition.
- v) In case of emergency, turn function switch to OFF position.

A.2.3 Portable Combustible Gas Indicator Johnson Instruments Model GP-204

Operation

Before taking instrument on the job, check battery voltage. To check, put switch in VOLT ADJ position. Meter should rise to the "CHECK" position near top of scale. Lift and turn VOLT ADJ. control clockwise to determine maximum voltage setting. If it cannot be set beyond mark, batteries need recharging or replacement for full capacity. Do not attempt to use instrument at all if reading cannot be set up to mark.

If voltage is satisfactory, continue with the next steps of preliminary adjustment as follows:

1. Confirm operation of pilot light/meter illuminating lamp.
2. With sample inlet in fresh air, squeeze bulb several times to flush out any remaining gas.
3. Check zero setting by turning switch to ON position. Meter should read close to zero. Lift and turn ZERO knob to bring reading to exactly 0.
4. Couple sampling hose to instrument inlet on left-hand end, and connect probe to end of hose.
5. Admit a sample of some combustible gas to end of probe, and confirm that meter rises upscale.

Instrument is now adjusted and ready to use. It may be turned off and carried to the job. To make a gas test, proceed as follows:

1. Turn to VOLT ADJ. position, adjust voltage if necessary, then turn to ON.
2. Hold probe within space to be tested. Squeeze bulb several times while watching meter, and observe maximum reading.
3. After completion of test, remove probe from test space, flush with fresh air for 4 or 5 squeezes of bulb, and turn off.

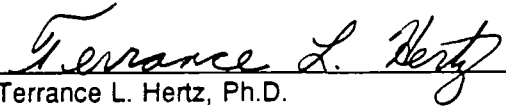



RMT, Inc.
100 Verdae Blvd.
P.O. Box 16778
Greenville, SC 29606
Phone: 803-281-0030
FAX: 803-281-0288


**MEDLEY FARM SITE
GAFFNEY, SOUTH CAROLINA
REMEDIAL DESIGN AND REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

June 1992

***Prepared for the
Medley Farm Site Steering Committee***


Terrance L. Hertz, Ph.D.
Laboratory Coordinator


Mark A. Miesfeldt
Project Hydrogeologist


Steve W. Webb, Ph.D., P.E.
Project Coordinator

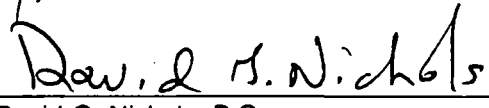

David G. Nichols, P.G.
Project Manager

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PREFACE

On January 17, 1992, a Consent Decree was entered into by the United States Environmental Protection Agency (US EPA) and the Medley Farm Site Steering Committee. As a part of this agreement, the Medley Farm Site Steering Committee agreed to provide the US EPA with the following documents within 45 days of US EPA's issuance of an authorization to proceed dated January 19, 1992:

- Field Sampling and Analysis Plan (FSAP),
- Quality Assurance Project Plan (QAPP),
- Health and Safety Plan, and
- A Technical Memorandum describing the Site Remedial Objectives.

The Field Sampling and Analysis Plan and the Quality Assurance Project Plan have been combined within this document. The Health and Safety Plan and Technical Memorandum have been submitted to the US EPA under separate cover.

Section 1

PROJECT DESCRIPTION

The Quality Assurance Project Plan (QAPP) presented in this document has been prepared to address the Supplemental Site Investigation (RI) and Remedial Design (RD) for the Medley Farm site, located near Gaffney, South Carolina (Figure 1-1). It has been prepared in accordance with US EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," (QAM-005/80, December 29, 1980). This QAPP is provided as supporting documentation for the RI/RD Investigation Work Plan for the Medley Farm site. Applicable project schedules and detailed procedures for sample collection, sample numbers, and locations are given in the applicable work plan documents.

1.1 Project Objectives

The objectives of the RI/RD are discussed in the FSAP and RD Work Plans. The objectives of this QAPP are to outline specific procedures that will be implemented to assure and control the quality and integrity of sample collection and analysis during the course of this investigation. This QAPP also establishes QA/QC procedures for field notes, data transcription, and data archival.

1.2 Criteria for Evaluating Data In Terms of Study Objectives

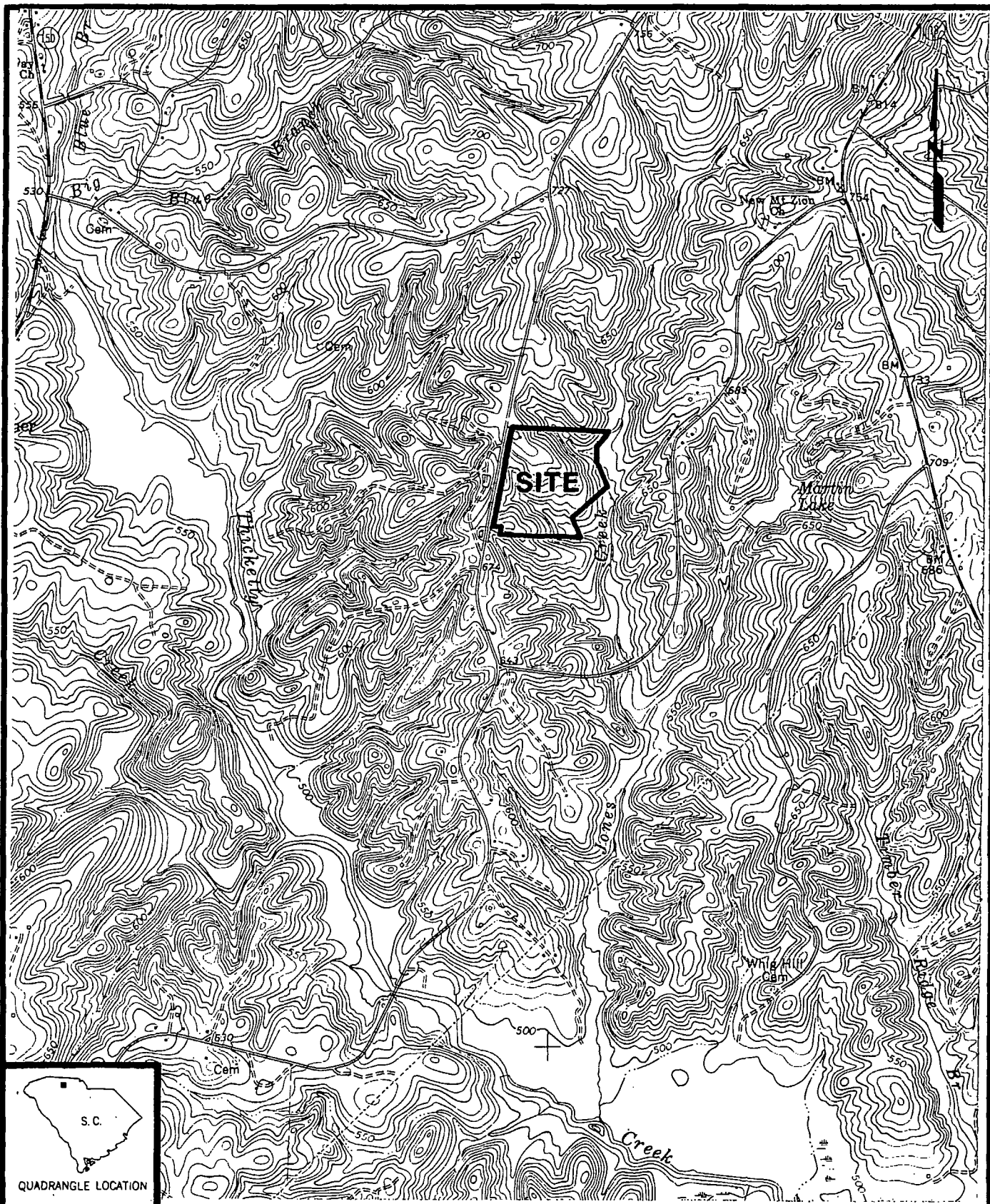
The data collected will be used to meet the requirements of the study objectives, which will be evaluated through a combination of the following criteria:

- Comparison to Background Concentrations - Background samples will be collected in the study area to establish background concentrations present. Data will be compared to background concentrations to determine if elevated concentrations are present and to assess potential remedial action levels.
- Comparison to Known Environmental Quality Standards - Constituents that have defined environmental quality standards for water or soil will be evaluated in terms of those standards to determine if concentration levels are unacceptable.

These criteria will allow evaluation of the extent and severity of effects to soils and ground water, migration pathways, and establishment of potential action levels for remedial actions.

1.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during RD/RA activities and are based on the end uses



PACOLET MILLS QUAD.

RMT^{INC} 938.04
0292

FIGURE 1-1
SITE LOCATION MAP
SCALE: 1"=2000'

MEDLEY FARMS
GAFFNEY, SC.

of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to ARARs, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on-site through the use of OVA, pH, conductivity, and other real-time monitoring equipment at the site.
- Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of quality control exercised. This level would specifically address the field analysis of volatile organic compounds previously detected in the unsaturated zone soil and/or ground water of the site. These soil and/or ground water samples will be analyzed on a portable gas chromatograph (GC). Soil and water headspace, and soil pore gas, can be analyzed with a GC. DQO Level 2 analyses are only planned for ground water samples.
- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation). DQO Level 3 analyses may include parameters for addressing such issues as scaling, corrosion, treatability, or other such engineering concerns.
- Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and PRP determination. These analyses require full Contract Laboratory Program (CLP) analytical and data validation procedures in accordance with EPA recognized protocol. Ground water, surface water, and stream sediments will be analyzed for volatile and semivolatile organic compounds as described in the FSAP.
- Non-Standard (DQO Level 5): This refers to analyses by non-standard and protocols (e.g., when lower detection limits, or extraction and analysis of an unusual chemical compound is required). These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data. No DQO Level 5 analyses are planned or anticipated.

Section 2

PROJECT ORGANIZATION AND RESPONSIBILITY

Personnel involved in the investigation, and in the generation of data as a result of investigation activities, become a part of the overall Project Quality Assurance program. Within that program, the following individuals have specific responsibilities: the Project Manager, the Project Coordinator(s), the Laboratory Coordinator, and Field Sampling Technician(s). Specific laboratory personnel with Quality Assurance/Quality Control responsibilities include the Laboratory Quality Assurance Officer and the Laboratory Sample Custodian.

2.1 Project Manager

The Project Manager for this investigation is responsible for general oversight of work to be conducted. The Project Manager also oversees scheduling and budgeting.

2.2 Project Coordinator(s)

A Project Coordinator is assigned to large-scale projects where the Project Manager cannot be present for all on-site activities. The Project Coordinator is primarily responsible for project Quality Assurance activity. The Project Coordinator's responsibilities include the development, evaluation, and documentation of the Quality Assurance Project Plan, including procedures appropriate to the investigation. The Project Coordinator will guide personnel in achieving a thorough understanding of the project Quality Assurance plan and their respective roles relative to one another within the established project framework.

The Project Coordinator is also responsible for the day-to-day activities of contractor field personnel. In this capacity, the Project Coordinator is responsible for the Quality Assurance of daily project activities and the maintenance of the Quality Assurance Project Plan. Further responsibilities include the review of field notebooks, driller's logs, and other field-related documentation.

2.3 Field Sampling Technician(s)

The Field Sampling Technicians are responsible for on-site sampling and sample handling activities. This includes proper labeling and security, chain-of-custody, analysis request forms, packaging and shipping.

2.4 Laboratory Coordinator

A Laboratory Coordinator is assigned to CERCLA projects to facilitate communication between project and laboratory staffs for unusual problems encountered during the field work which require special communication between the analytical laboratory, field personnel, and the consulting staff. The Laboratory Coordinator is responsible for coordinating field sampling and laboratory activities, performing data QA reviews, and maintaining clear communication between laboratory and field personnel.

2.5 Laboratory Quality Assurance Officer

The nature of analytical work for this project necessitates that the analytical laboratory specify a Laboratory Quality Assurance Officer whose duties are specific to the project. The Laboratory Quality Assurance Officer is responsible for maintenance of Laboratory Quality Assurance activities associated with the project.

2.6 Laboratory Sample Custodian

The Laboratory Sample Custodian is responsible for assuring that proper sample entry, internal laboratory and external shipping chain-of-custody, and sample handling procedures are followed by laboratory personnel.

Section 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

Data quality requirements are based on the intended use of the data, the measurement process, and the availability of resources. Data quality requirements include detection limits, accuracy, and precision. Quality Assurance protocols for the analytical methods to be used and the analyses to be conducted. Specific guidelines for accuracy, precision, completeness, and representativeness are discussed in the following subsections. Field blank, trip blank, decontamination evaluation (i.e., "rinsate") blanks, and field duplicates described in Section 11 of this QAPP will be subjected to the same Quality Assurance objectives as samples.

3.1 Accuracy

Accuracy is defined as the degree of agreement of a measurement or average of measurements with an accepted reference or true value. The project-specific QA objectives established for accuracy are expressed in the following parameters.

3.1.1 Reference Materials

Reference materials used as calibration standards or surrogate compounds will be certified, commercially available materials.

3.1.2 Instrument Performance

Instruments used in this project will be checked each day that samples are analyzed to demonstrate instrument performance. The QA objectives for instrument sensitivity, calibration, and performance are established in CLP and other US EPA protocols. These protocols are listed in Section 9 of this QAPP.

3.1.3 Recovery of Surrogates

Surrogate compound recovery is utilized to evaluate proper performance of the analytical method and/or possible matrix interference to the analytical method for organic compounds.

The recovery of a surrogate compound (S) added to a sample will be defined as follows:

$$\text{Recovery \%} = \frac{\text{ug S found in sample}}{\text{ug S added to sample}} \times 100$$

This equation assumes that the surrogate is not present in the sample. The objectives for recovery of surrogates from water and soil matrices are given in the CLP Statement of Work for Organics (March 1990).

3.1.4 Recovery of TCL/TAL Analytes

The recovery of analytes from samples will be evaluated using matrix spikes. Representative analytes will be added ("spiked") into samples. Matrix spikes and matrix spike duplicates will be performed at the frequency specified in the CLP Protocol. The spike recovery of an analyte (X) will be defined as follows:

$$\text{Spike Recovery (\%)} = \left(\frac{\text{ug X found in spiked sample} - \text{ug X in native sample}}{\text{ug X added to sample}} \right) \times 100\%$$

Spike recovery data is used to check for possible sample matrix interferences. The objectives for the spike recovery from soil and water matrices are given in the CLP protocols.

3.2 Precision

Precision is defined as a measure of mutual agreement among individual measurements of a sample property. The project QA objectives established for precision are expressed in the following parameters.

3.2.1 Analysis of Standards

One of the QA objectives for this project is that each initial calibration curve and subsequent (i.e., "continuing") calibration standards meet or exceed the minimum QA criteria established in the CLP protocols.

3.2.2 Analysis of Spiked Samples

A second QA objective for this project is that the results of spiked samples (i.e., matrix spikes) and spiked sample duplicates (i.e., matrix spike duplicates) be within the advisable recovery and Relative Percent Difference (RPD) limits specified in the CLP analytical protocols.

3.2.3 Analysis of Duplicate Samples

A third QA objective for this project is that analyte concentrations be comparable within duplicate samples. This includes 1) duplicate samples collected in the field, 2) duplicate analyses resulting from matrix spike and matrix spike duplicate samples, and 3) results generated from multiple analyses of a sample performed at the laboratory.

A measure of precision is Relative Percent Difference (RPD) of two analyses of the same sample. This measure is applied as a quality control criterion to the recovery of organic matrix spike compounds. RPD is defined as follows:

$$RPD = \frac{|\text{First Analysis Value} - \text{Second Analysis Value}|}{(\text{First Analysis Value} + \text{Second Analysis Value})/2} \times 100\%$$

RPD criteria for organic matrix spike compounds are given in the CLP Protocol.

3.3 Completeness

The QA completeness objective for this program is to obtain analytical results for at least 95 percent of the samples submitted for analyses.

3.4 Representativeness

Sampling sites, sampling frequency, sample preservation, sampling procedures, and sampling equipment will be addressed in the site-specific sampling and analysis plan to obtain representative samples.

3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Data acquired for different purposes using different analytical methods, or different DQOs, may not be directly comparable. Samples analyzed using CLP (DQO Level 4) protocols are expected to be comparable.

3.6 Field Measurement Data

Precision and accuracy for field pH and conductivity are dependent on the type and condition of the instrument used and the care used in standardization and operation of that instrument. The precision and accuracy objectives for the instrumentation used are as follows:

- The pH precision will be ± 0.3 pH standard units and an accuracy of ± 0.3 pH standard units. Field pH measurements will be reported to the nearest oil standard unit.
- Conductivity precision will be ± 3 umhos/cm on the 500 umhos/cm range, 25 umhos/cm on the 5,000 umhos/cm range and 250 umhos/cm on the 50,000 umhos/cm range. Accuracy for conductivity measurements are a function of the conductivity reading for the probe and instrument combined.

Section 4

SAMPLING PROCEDURES

Sample container, preservation procedures and holding time requirements are presented in Table 4-1. Precleaned sample containers will be obtained from sample bottle suppliers such as I-Chem Research, Inc., New Castle, Delaware, and Pierce Chemical Company, Rockford, Illinois. The preparation of sample bottles (e.g., preservative added) will be documented.

Detailed procedures for sample collection, number, and location are given in the FSAP and RD Work Plans. The collection of blanks, duplicate samples, and spike samples will be discussed in Section 11 of this QAPP.

When samples requiring preservation by either acid (except samples for volatile organic compound analysis) or base are received at the laboratory, the pH will be measured and documented. The pH will be adjusted by the Laboratory Sample Custodian, if necessary, and the Laboratory Coordinator will be promptly notified of the pH adjustment so that sample collection procedures can be reviewed to determine if a modification is necessary. The Laboratory Sample Custodian will then store the sample in a secure sample storage cooler maintained at 4°C and maintain custody until the sample is discarded.

QAPP TABLE 4-1

**RECOMMENDED HOLDING TIMES FOR PRESERVATION PROCEDURES
AND CONTAINER TYPES FOR ANALYSES**

Sample Analysis	Holding Time ^a		Preservation Procedures		Container Type	
	Water	Soil/Sediment	Water	Soil/Sediment	Water	Soil/Sediment
Volatile Organic Compounds	14 days	14 days	4°C, 4 drops 1:1 HCl	4°C	three 40 mL glass, Teflon lined septum (min.)	two 4 oz glass, Teflon lined lid (min.)
Semi-Volatile Organic Compounds	7 days until extraction; 40 days after extraction	14 days until extraction; 40 days after extraction	4°C	4°C	two 1 liter amber glass, Teflon lined lid (min.) ^b	one 500 mL amber glass, Teflon lined lid (min.)
Temperature, field pH, and Conductivity	Immediately after sample collected	---	---	---	---	---

^a Starting from time of sample collection.

^b Four containers to be collected for MS/MSD samples.

Section 5

SAMPLE CUSTODY

The field technician performing sample collection activities will be responsible for sample custody in the field. The laboratory sample custodian and analysts will be responsible for custody of the sample at the laboratory.

5.1 Field Chain-of-Custody

Prior to collecting samples in the field, the Field Sampling Technicians will obtain the sample bottles necessary for the field operation. Field samplers will label each sample collected, filling in the appropriate information in waterproof ink. The field sampler will be responsible for collecting the samples and for logging the samples into assigned field notebooks. The field sampling technicians will complete and verify the Chain-of-Custody forms (Figure 5-1). A copy of the Chain-of-Custody will be placed in the project files and the original will accompany the shipped samples. The identity of field duplicate samples will not be disclosed to the Analytical Laboratory. Sample analysis request forms (Figure 5-2) will be prepared by the Laboratory Coordinator, or prepared by a Field Technician and reviewed by the Laboratory Coordinator. The analytical request forms will accompany samples, or precede delivery of samples, to the laboratory.

5.2 Transfer of Custody

Shipping containers will be sealed and accompanied by the Chain-of-Custody record, with appropriate signatures. The transfer of custody is the responsibility of the Field Sampling Technicians and the laboratory.

5.3 Laboratory Custody Procedures

In the laboratory, a sample custodian will be assigned to receive the samples. Upon receipt of a sample, the custodian will inspect the condition of the samples, reconcile the sample(s) received against the Chain-of-Custody record, log in the sample(s) in the laboratory log book, and store the sample(s) in a secured sample storage room or cabinet until assigned to an analyst for analysis.

The sample custodian will inspect the sample for any leakage from the container. A leaky multi-phase sample will not be accepted for analysis as this sample would no longer be a representative sample.

RMT
LABORATORIES

CHAIN OF CUSTODY RECORD

[illegible]

WHITE - LABORATORY COPY

Figure 5-2 Laboratory Analysis Request Form for Organics (Front)

SAMPLES STORED yes__ SAMPLES RETURNED yes__ SAMPLES DISPOSED yes__ (Default = DISPOSED)

RMT Laboratories - ORGANIC WORK ORDER FORM

Submitter: _____ Report To: _____ Project Manager: _____ Project Number: _____ RMT Office: _____ Project Name: _____ Lab Price Quote Number: _____ Report Target Date: _____ (Default = 3 weeks) Quick Turn: 1 week _____ (with approval) Quick Turn: 2 weeks _____ (with approval)		(TO BE COMPLETED BY LABORATORY PERSONNEL) LIMS Work Order ID: _____ Analysis Target Date: _____ Technical Review By: _____ Date: _____ LIMS Entry By: _____ Date: _____ Sample Matrix: EPT EPW ATH TCP GW WW SW OTHER							
Parameter/Method	LIMS Test ID								Number of Samples
VOLATILES	a. 8010 / 801	S/W VOA8010, WVOA801							
	b. 8020 / 802	S/W VOA8020, WVOA802							
	c. 8030 / 803	S/W VOA8030, WVOA803							
	d. 8140 / 814	S/W VOA 8140/814							
	e. 802.3 / SDWA	S/W VOA802							
	f. 824.3 / SDWA	S/W VOA824							
	g. TCL (HSL)	S/W VOATCL							
	h. PP	S/W VOA1							
	i. TCLP - VOA	TVOA10M							
	j. Appendix IX	S/W VOALX							
k. Unknown volatiles	•UNKNOWNV								
TPH*	a. Extraction	S/W TPHEXT							
	b. Diesel	S/W TPHGC							
	c. Gas	S/W TPHGCC1							
	d. Kerosene	S/W TPHGCC2							
PESTICIDES	a. 808 / 8080	S/W PCBPEST							
	b. 808 / 8080	S/W PCB							
	c. 8140	S/W OCP8140							
	d. 8150	SHRB8150							
	e. TCLP - Pesticide	TPEST7M							
	f. TCLP - Herbicide	THERB2M							
	g. 805 / SDWA	S/W PEST 805							
	h. 815.1 / SDWA	S/W PEST 815							
	i. 807 / SDWA	S/W PEST 807							
	j. TCL (HSL)	S/W PCBPEST							
	k. PP	S/W PESTCL							
	l. Appendix IX	S/W PIX							
	m. Extraction	S/W EXT							
SEMIVOLATILES	a. 804 / 8040	S/W ACID							
	b. 805 / 8050	WBN2605, SBN28050							
	c. 809 / 8090	S/W BNAPHTH							
	d. 825 / PNA	S/W PNA825							
	e. 811 / 8110	S/W HALO							
	f. 812 / 8120	S/W CHYD							
	g. 828 / 8270	WBNA828, S/W BNA8270							
	h. 825 / SDWA	WSDWA							
	i. TCLP - BNA	TBNA13M							
	j. TCL (HSL)	WBNA825, S/W BNA8270							
	k. PP	WBNA825, S/W BNA8270							
	l. Appendix IX	S/W BNAIX							
	m. Extraction	S/W EXT							
	n. Unknown semi-volatiles	•UNKNWNB							
FIELD DATA	FLDDATA								

* For TPH by IR Methods, see Inorganic Work Order Form, LF-233A.
LIST SINGLE PARAMETERS ON OTHER SIDE.

Figure 5-2b

RMT Laboratories - ORGANIC WORK ORDER FORM
Single Parameters

Parameter/Method	LINE Test ID												Number of Samples
V O L A T I L E S	1. _____												
	2. _____												
	3. _____												
	4. _____												
	5. _____												
P C B / P E S T	1. _____												
	2. _____												
	3. _____												
	4. _____												
S E M I / V O L A T I L E	ACIDS												
	1. _____												
	2. _____												
	3. _____												
B A S E N E U T R A L S	BASE NEUTRALS												
	1. _____												
	2. _____												
	3. _____												
SPECIAL INSTRUCTIONS: _____ _____ _____												HAZARDS ASSOCIATED WITH SAMPLES: _____ _____ _____	

The custodian will examine whether the sample bottle seal is intact or broken, since a broken seal may mean sample tampering and may make analytical results inadmissible in court as evidence. The Laboratory Coordinator will be promptly notified of broken seals so that appropriate action may be taken (e.g., collect another sample).

Discrepancies observed between the samples received, the information that is on the Chain-of-Custody record, and the sample analysis request sheet will be resolved before the sample is assigned for analysis. The Laboratory Coordinator will be informed of any such discrepancy as well as its resolution. Results of the inspection will be documented in the laboratory sample log book. Discrepancies will be documented in the analytical case narrative, as appropriate.

5.4 Sample Labels and Seals

A self-adhesive sample label (Figure 5-3a) will be affixed to each sample bottle before sample collection. At a minimum, the sample label will contain the following:

- Client - Job Name/Project Number,
- Sample Identification,
- Date and Time Collected (except for duplicate samples),
- Sampler's Signature (or initials), and
- Preservatives Added.

After a sample has been collected, a self-adhesive bottle custody seal (Figure 5-3b) will be placed over the sample bottle lid. The custody seal will be initialed by the sample technician.

Figure 5-3a Example of Sample Bottle Label

RMT™ 100 VERDAE BLVD.
P.O. BOX 16778
GREENVILLE, SC 29606
(803) 281-0030

PRESERVATIVE (CIRCLE)
☒ NONE NaOH HNO₃ H₂SO₄
OTHER _____

PROJECT # (CLIENT) _____

SAMPLE ID _____

DATE/TIME _____

COLLECTOR _____

TYPE (CIRCLE) GRAB COMP FILTERED OTHER _____

ANALYZE FOR _____

LABORATORY # _____

Figure 5-3B Example of Sample Bottle Custody Seal

CUSTODY SEAL

Person Collecting Sample _____ Sample No. _____
(signature)

Date Collected _____ Time Collected _____

Section 6

SHIPPING OF SAMPLES

Environmental samples will be transported as follows:

- 1) Collect the sample in appropriate containers.
- 2) Wrap glass sample containers in bubble wrap to protect from breakage. Small (less than 500 ml) glass containers will also be placed in plastic (e.g., Zip-Lock) bags.
- 3) Place the sample containers in a strong outside container such as a picnic cooler. Pour crushed ice around sample containers.
- 4) Place the signed Chain-of-Custody forms inside the cooler. If analytical request forms have not already been sent to the laboratory, place them inside the cooler. Retain one copy of the signed Chain-of-Custody and store it in the project files.
- 5) Each sample shipping container will be sealed with tape prior to shipping.
- 6) Clearly label each container's exterior with its destination.
- 7) Ship via air freight or other overnight carrier.

If samples are personally delivered to the laboratory by the sampling teams, steps 2, 5, 6, and 7 can be omitted.

Section 7

SAMPLING SITE LOCATION AND SAMPLING ACTIVITY IDENTIFICATION

7.1 Field Log Book

Information pertinent to the soil and ground water investigation will be recorded in field log books. Field log books will be bound, with consecutively numbered pages. The pages will be dated and signed by the person who is recording the information. Unused space at the bottom of a page will be crossed through. Work sketches or phrases that are recorded but deemed incorrect will be marked through in such a way as to still be legible, yet obviously struck from the text. Mark-throughs will be initialed and dated by the person striking the item.

Persons leading a sampling team or performing a distinct task will be issued a field log book by the Project Coordinator. That person will maintain the log book during the RI. At the conclusion of the various phases of the RI, the field books will be collected and reviewed by the Project Coordinator.

7.2 Photographs

Sampling site locations will be identified on a site map. The location will be cross-referenced in the field notebook as to the identification of samples collected from the site location. Photographs of the sampling site location and the activities occurring at a specific location will be made. Photographs will be cross-referenced with an identification/explanation narrative in the field notebook.

Section 8 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Laboratory Calibration

The calibration procedures to be used for this project are summarized below, and will follow the March 1990 CLP Statement of Work for Organics.

8.1.1 Instrument Performance and Tune

Prior to analysis of each set of samples and on a daily basis during the analysis, it will be demonstrated that the instrument meets the operating performance standards established in the CLP protocols. If an instrument does not meet the performance standards it will be tuned until the performance criteria are achieved.

8.1.2 Calibration Curve

For analyses of Target Compound List (TCL) components, instruments will be calibrated prior to the analysis of each batch of samples by analyzing known mixtures of the group of compounds under study as required by CLP protocols. Instrument calibration will be verified daily as prescribed in the protocols. A new calibration curve will be established if the response observed in the analysis of the continuing calibration check standard varies outside of prescribed protocol limits.

8.2 Field Calibration

In addition to the laboratory analyses conducted during the course of this investigation, field measurements of pH, specific conductance, and temperature will be taken for ground water samples. Field Analyses of headspace over ground water for selected unsaturated volatile organic compounds will be performed. An air monitoring device (e.g., OVA, HNu, Microtip) will be used to analyze ambient air for potentially hazardous concentrations of volatile organic compounds.

The frequency of field calibration procedures will, at a minimum, include the following:

- The pH meter will be calibrated and the specific conductance meter will be standardized a minimum of twice daily or after every ten samples and documented in the calibrator's field book.

- The pH meters will be calibrated using specific techniques according to the manufacturer's instructions and two standard buffer solutions (either 4.0, 7.0, or 10.0). The pH values of these buffers will be compensated for temperature according to the values supplied on the manufacturer's bottle label. The temperature (measured as below) at which the sample pH was measured will then be used to compensate for temperature on the meter.
- Temperature measurements will be performed using the thermometer function on the conductivity meter which is calibrated to a National Bureau of Standard (NBS) specification thermometer. Measurements will be recorded to the nearest °C. This level of accuracy is sufficient for the temperature measurements required by this project.
- The field gas chromatograph will be calibrated with a standard at the beginning of each day of operation. Retention times will be checked hourly during operation using the standard. The calibration standard will have one part per million (mg/L) of 1,1-dichloroethene, trichloroethene, tetrachloroethene, and toluene in water.
- Equipment for monitoring ambient air for volatile organic compounds (e.g., HNu, OVA, or Microtip analyzer) will be calibrated daily prior to use.

Section 9

ANALYTICAL METHODS

This section describes the analytical methods to be used during the Supplemental Site investigation as required by the ROD.

9.1 Laboratory Analysis

The analytical procedures utilized in performing the remedial investigation (DQO Level 4) will conform to the protocols contained in the March 1990 US EPA Contract Laboratory Program (CLP) Statements of Work (SOW) for Organics. Samples will be analyzed for volatile and semi-volatile analytes on the Target Compound List (TCL). The TCL volatile and semivolatile analytes, along with their quantitation limits, are presented in Tables 9-1 and 9-2, respectively.

Some of the Contract Required Quantitation Limits for volatile organic compounds (VOCs) in the 1990 EPA CLP SOW exceed the National Drinking Water Standard Maximum Contaminant Levels (MCLs). If data quality needs change and require lower detection limits, then the Superfund Analytical Methods for Low Concentration Water Organic Analysis (June 1991) will be used for analyzing VOCs in applicable samples. The VOCs and quantitation limits for this low concentration method are presented in Table 9-3.

Analytical methods and parameters used to engineer the remedial design will be specified in the Remedial Design Work Plan. These would include such issues as scaling, precipitation, and corrosivity; and monitor parameters such as hardness, alkalinity, calcium, iron, and manganese, which utilize DQO Level 3.

9.2 Field Analyses

The procedure for field measurements of unsaturated volatile organic compounds using a portable gas chromatograph are described in Section 5.6 of the FSAP.

TABLE 9-1
TCL VOLATILE ORGANIC COMPOUNDS

Volatiles	<u>Quantitation Limits</u>		
	<u>Water</u> ug/L	<u>Low Soil</u> ug/Kg	<u>Med. Soil</u> ug/Kg
Chloromethane	10	10	1200
Bromomethane	10	10	1200
Vinyl Chloride	10	10	1200
Chloroethane	10	10	1200
Methylene Chloride	10	10	1200
Acetone	10	10	1200
Carbon Disulfide	10	10	1200
1,1-Dichloroethene	10	10	1200
1,1-Dichloroethane	10	10	1200
1,2-Dichloroethene (total)	10	10	1200
Chloroform	10	10	1200
1,2-Dichloroethane	10	10	1200
2-Butanone	10	10	1200
1,1,1-Trichloroethane	10	10	1200
Carbon Tetrachloride	10	10	1200
Bromodichloromethane	10	10	1200
1,2-Dichloropropane	10	10	1200
cis-1,3-Dichloropropene	10	10	1200
Trichloroethene	10	10	1200
Dibromochloromethane	10	10	1200
1,1,2-Trichloroethane	10	10	1200
Benzene	10	10	1200
trans-1,3-Dichloropropene	10	10	1200
Bromoform	10	10	1200
4-Methyl-2-pentanone	10	10	1200
2-Hexanone	10	10	1200
Tetrachloroethene	10	10	1200
Toluene	10	10	1200
1,1,2,2-Tetrachloroethane	10	10	1200
Chlorobenzene	10	10	1200
Ethyl Benzene	10	10	1200
Styrene	10	10	1200
Xylenes (Total)	10	10	1200

TABLE 9-2
TCL SEMIVOLATILE ORGANIC COMPOUNDS

Semivolatiles	Quantitation Limits*		
	Low		Med.
	Water ug/L	Soil ug/Kg	Soil ug/Kg
Phenol	10	330	10000
bis(2-Chloroethyl) ether	10	330	10000
2-Chlorophenol	10	330	10000
1,3-Dichlorobenzene	10	330	10000
1,4-Dichlorobenzene	10	330	10000
1,2-Dichlorobenzene	10	330	10000
2-Methylphenol	10	330	10000
2,2'-oxybis (1-Chloropropane)*	10	330	10000
4-Methylphenol	10	330	10000
N-Nitroso-di-n- propylamine	10	330	10000
Hexachloroethane	10	330	10000
Nitrobenzene	10	330	10000
Isophorone	10	330	10000
2-Nitrophenol	10	330	10000
2,4-Dimethylphenol	10	330	10000
bis(2-Chloroethoxy) methane	10	330	10000
2,4-Dichlorophenol	10	330	10000
1,2,4-Trichlorobenzene	10	330	10000
Naphthalene	10	330	10000
4-Chloroaniline	10	330	10000
Hexachlorobutadiene	10	330	10000
4-Chloro-3-methylphenol	10	330	10000
2-Methylnaphthalene	10	330	10000
Hexachlorocyclopentadiene	10	330	10000
2,4,6-Trichlorophenol	10	330	10000
2,4,5-Trichlorophenol	25	800	25000
2-Chloronaphthalene	10	330	10000
2-Nitroaniline	25	800	25000
Dimethylphthalate	10	330	10000
Acenaphthylene	10	330	10000
2,6-Dinitrotoluene	10	330	10000
3-Nitroaniline	25	800	25000
Acenaphthene	10	330	10000
2,4-Dinitrophenol	25	800	25000
4-Nitrophenol	25	800	25000

TABLE 9-2 (cont)
TCL SEMIVOLATILE ORGANIC COMPOUNDS

Semivolatiles	<u>Quantitation Limits</u>		
	<u>Water</u>	<u>Low</u>	<u>Med.</u>
	<u>ug/L</u>	<u>Soil</u>	<u>Soil</u>
		<u>ug/Kg</u>	<u>ug/Kg</u>
Dibenzofuran	10	330	10000
2,4-Dinitrotoluene	10	330	10000
Diethylphthalate	10	330	10000
4-Chlorophenyl-phenyl ether	10	330	10000
Fluorene	10	330	10000
4-Nitroaniline	25	800	25000
4,6-Dinitro-2-methylphenol	25	800	25000
N-nitrosodiphenylamine	10	330	10000
4-Bromophenyl-phenylether	10	330	10000
Hexachlorobenzene	10	330	10000
Pentachlorophenol	25	800	25000
Phenanthrene	10	330	10000
Anthracene	10	330	10000
Carbazole	10	330	10000
Di-n-butylphthalate	10	330	10000
Fluoranthene	10	330	10000
Pyrene	10	330	10000
Butylbenzylphthalate	10	330	10000
3,3'-Dichlorobenzidine	10	330	10000
Benzo(a)anthracene	10	330	10000
Chrysene	10	330	10000
bis(2-Ethylhexyl)phthalate	10	330	10000
Di-n-octylphthalate	10	330	10000
Benzo(b)fluoranthene	10	330	10000
Benzo(k)fluoranthene	10	330	10000
Benzo(a)pyrene	10	330	10000
Indeno(1,2,3-cd)pyrene	10	330	10000
Dibenz(a,h)anthracene	10	330	10000
Benzo(g,h,i)perylene	10	330	10000

TABLE 9-3
SUPERFUND LOW CONCENTRATION
VOLATILE ORGANIC COMPOUNDS

Volatiles	Quantitation Limits
	Water ug/L
Chloromethane	1
Bromomethane	1
Vinyl chloride	1
Chloroethane	1
Methylene chloride	2
Acetone	5
Carbon disulfide	1
1,1-Dichloroethane	1
1,1-Dichloroethane	1
cis-1,2-Dichloroethene	1
trans-1,2-Dichloroethene	1
Chloroform	1
1,2-Dichloroethane	1
2-Butanone	5
Bromochloromethane	1
1,1,1-Trichloroethane	1
Carbon Tetrachloride	1
Bromodichloromethane	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
Trichloroethene	1
Dibromochloromethane	1
1,1,2-Trichloroethane	1
Benzene	1
trans-1,3-Dichloropropene	1
Bromoform	1
4-Methyl-2-pentanone	5
2-Hexanone	5
Tetrachloroethene	1
1,1,2,2-Tetrachloroethane	1
1,2-Dibromoethane	1
Toluene	1
Chlorobenzene	1
Ethylbenzene	1
Styrene	1
Xylenes (total)	1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,2-Dichlorobenzene	1
1,2-Dibromo-3-chloropropane	1

Section 10

DATA REPORTING, VALIDATION, AND REDUCTION

Data validation practices will be followed to assure that raw data are not altered and that an audit trail is developed for data which require reduction. Field data, such as those generated during field measurements, will be entered directly into a bound field notebook. The Technical Coordinator will review field measurements recorded in the field books. Project team members will be responsible for proofing data transfers.

The Laboratory Quality Assurance Officer will validate the laboratory analytical data before it is released. This effort will include an inspection to determine if the data meet the QA/QC criteria specified in each analytical protocol, and which are generically discussed in Section 3 of this QAPP. Aspects of the data which do not meet applicable QA/QC guidelines, and deviations from established analytical procedures, will be documented in a narrative accompanying the data.

Analytical Data Reports will be available from the laboratory within five weeks following the receipt of the samples. Upon receipt of the laboratory data reports, the data will be checked by the Laboratory Coordinator. This procedure will involve the review of data, reporting units, laboratory method blanks, field blanks, trip blanks, rinsate blanks, the agreement between samples and duplicates, surrogate and spike recoveries, and the case narrative.

RMT anticipates that data reduction for this phase of the investigation will consist of tabulating analytical results from Analytical Data Reports into summary tables through the use of computerized database and spreadsheet software. Reduced data will be placed in the central file maintained by the Project Manager.

Raw field specific conductance data will be reported as micromhos per centimeter (umhos/cm), and will be corrected to 25°C. The pH measurements will be reported as standard units, and temperature will be reported in degrees Centigrade (°C). Hardcopy CLP analytical data will be reported in units consistent with CLP protocols. Diskette deliverable data, if generated, will be in RMT's proprietary format and will have analyte concentrations reported in parts per million (ppm).

The data validation program will track investigation documentation so that it is available when the remedial investigation and design have been completed. Accountable documentation include items such as log books, field data records, correspondence, Chain-of-Custody records, analytical reports, photographs, computer disks, and final reports. The Project Manager is responsible for maintaining a file in which all accountable documents will be inventoried. Raw data generated during field operations will be filed to eliminate or correct errors arising from the transfer of data.

In order to avoid errors in the transfer of data, copies of raw data from the field notebooks and the data as received from the laboratory will be entered into a data file. The data file will serve as the ultimate archive for information and data generated during this RI/RD.

Section 11

INTERNAL QUALITY CONTROL CHECKS

Internal Quality Control Checks of field activities will be utilized during this investigation through the use of the following:

- **Field Blanks** - These blanks consist of organic free, deionized water contained in each sample container with any preservatives required for that analysis. These will serve as a QC check on the field sampling methods for CLP analytes, container cleanliness, and external contamination. A field blank will be submitted for each sampling event.
- **Trip Blanks** - These blanks consists of organic free, deionized water contained in volatile organic compound (VOC) sample containers and preserved similar to VOC samples. These samples serve as a QC check on potential external contamination and/or cross-contamination between VOC samples during shipping and storage. A trip blank will accompany each cooler of VOC samples sent to the laboratory.
- **Rinsate Blanks** - These are samples of organic free, deionized water which have been in contact with decontaminated sampling and/or drilling equipment. These samples serve as a QC check on the field decontamination procedure. A Rinsate Blank will be collected bi-weekly during each field event when on-site decontamination of equipment is performed.
- **Field Duplicate Samples** - Duplicate samples will be collected to allow determination of analytical repeatability and sample homogeneity. At a minimum, one duplicate sample for every twenty ground and/or surface water samples, and one duplicate for every twenty soil and/or sediment samples, will be collected and submitted for analysis.
- **Matrix Spike/Matrix Spike Duplicate Samples** - A matrix spike/matrix duplicate sample will be submitted as a further QC check. Matrix spike/matrix spike duplicate samples are actually laboratory analytical QC items which are discussed here because sufficient sample must be collected in the field in order to perform these analyses. These samples will be collected at the same frequency as stated above for the duplicate samples. These samples will allow the amount of recovery of spike compounds (the spike compounds are defined in the CLP protocols) to be determined for matrix effects specific to the study site, through the addition of known concentrations of compounds into the sample at the laboratory and then performing the analysis. The level of added constituent incorporated into QC samples will be consistent with the CLP protocol. The frequency of matrix spike/matrix duplicate samples will also be consistent with CLP protocol.

Extra volume of ground and surface water will be collected at sampling points chosen for duplicate and matrix spike samples. Soil and sediment samples will be homogenized prior to placement into a clean sample container. Homogenization will be performed by mixing a soil volume large enough to fill the sample container (and duplicate and matrix spike containers, if applicable) on a stainless steel pan with

a stainless steel trowel. This homogenization procedure is performed due to the tendency of soil samples to be nonhomogeneous with respect to constituent levels. Samples collected for volatile organic compound analyses will not be homogenized because of potential loss of analytes due to volatilization during the homogenization process.

Duplicate samples will be labeled in a manner such that their sampling point location is not disclosed to the laboratory. The duplicate sample number (e.g. DU-1) and its corresponding sample location will be recorded in the field notebook. Sampling date and time will not be filled out on the label of the duplicate sample nor on the Chain-of-Custody form in order to not to disclose the duplicate's sample point location.

Where more than one sample of a given matrix (e.g. soil, water, waste) is collected, sufficient sample volume will be collected for matrix spike and matrix spike duplicate (MS/MSD) analyses at a minimum of two sample locations. This allows the laboratory to select the sample for MS/MSD analyses.

Section 12

PERFORMANCE AND SYSTEM AUDITS

On-site audits may be performed to review field-related Quality Assurance activities. The audits would be conducted by the Technical Coordinator.

Specific elements of the on-site audit include verification of the following:

- Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions and signatures;
- Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, person(s) collecting sample, preservation method used, and type of testing required;
- Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person(s) collecting samples, types of samples, results of field measurements, soil logs and problems encountered during sampling;
- Adherence to health and safety guidelines including wearing of proper protective clothing. Level D protective clothing will be worn at a minimum and will be upgraded, if necessary, as specified in the Health and Safety Plan;
- Adherence to decontamination procedures as outlined in the site Health and Safety Plan, including proper washing or steam cleaning of pumps and pump tubing, bailers, and soil sampling equipment;
- Adherence to sample collection, preparation, preservation, and storage procedures as outlined in this Work Plan.

Section 13

PREVENTIVE MAINTENANCE

The maintenance procedures discussed in the following subsections will be performed to maximize efficiency and minimize downtime in the laboratory and while working on the Medley Farm site.

13.1 Laboratory Maintenance

Specific routine maintenance procedures, preventive maintenance procedures, and maintenance logs for the GC-MS system will be documented/maintained by the Laboratory. This documentation will be available for review if requested by the investigation staff or the Medley Farm Site Steering Committee.

13.2 Field Maintenance

Routine daily maintenance procedures conducted in the field will include the following:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment measurement systems.
- Storage of equipment away from the elements.
- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing; weak batteries).

Spare and replacement parts stored in the field to minimize downtime include the following:

- Appropriately sized batteries,
- Extra precleaned sample bottles,
- Locks,
- Thermometers,
- pH probes, and
- Buffer solutions.

Section 14

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION ACCURACY AND COMPLETENESS

14.1 Laboratory Data Quality Assessment

Data quality will be assessed using CLP protocol-specific criteria and laboratory defined validation methods described in National Functional Guidelines for Organic Data Review (June 1991). Data qualifiers described in the latter document will not be applied to the data. RMT personnel will be advised of data having questionable or unacceptable quality and procedural deviations noted in the case-SDG narrative.

14.2 Project Data Quality Assessment

14.2.1 Laboratory Data Assessment

Data will be validated by the Laboratory Quality Assurance Officer prior to its release. The Laboratory Coordinator will conduct a second level data validation and review of data as it is received from the Laboratory. This data will then be incorporated into the next routine monthly QA report that would be submitted to US EPA. The Laboratory Coordinator will check that data packages include a narrative to document variations from the analytical protocol and actions taken by the laboratory to address those variations.

14.2.2 Field Data Quality Assessment

To assist in collecting field data accurately and correctly, specific instructions will be issued by the Technical Coordinator to personnel involved in field data acquisition. At the end of each field event the Technical Coordinator will review the field books used by project personnel to check that tasks were performed as specified in the instructions. Field books will be reviewed periodically throughout the entire project.

Raw data and reduced data will be submitted by project personnel to the Technical Coordinator for review. Equations, calculations, data transfers, consistent units, and significant figures will be subject to this Quality Assurance review.

Section 15 CORRECTIVE ACTION

15.1 Laboratory Corrective Action

Corrective actions are required when an out-of-control event or potential out-of-control event is noted. The corrective action taken is somewhat dependent on the analysis and the event.

Examples of "out-of-control" events are:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA Department.

The laboratory will provide documentation as to what, if any, corrective actions were initiated concerning this study and report them to the Laboratory Coordinator.

15.2 Contamination

For each matrix analyzed, the Laboratory Coordinator will review the data from the analysis of field, trip, rinsate, and method blanks. If excessive contamination (i.e., levels above allowable limits set within the

CLP protocols) is found in the blanks, corrective action will be taken, including requesting that the analytical laboratory:

- check raw data and calculations, and
- if the contaminating analyte is also present at high levels in field samples, repeat the analysis of the laboratory stored sample or sample extract.

If the contamination does not appear to originate at the laboratory, the Laboratory Coordinator, in conjunction with the Technical Coordinator, will review field sampling procedures to determine if a change in field sampling protocol is necessary.

15.3 Missing or Lost Samples or Data

The objective for completeness is 95 percent. If samples or data are lost during sampling and analysis activities, corrective actions will be taken, including:

- requesting that the analytical laboratory reanalyze stored samples or extracts, if available, and
- repeating collection and analysis of ground water samples.

Section 16
QUALITY ASSURANCE DOCUMENTATION TO US EPA

The Project Manager, in conjunction with the Project Coordinators and Laboratory Coordinator, will submit a project status report each month. This report may include the following types of information relating to Quality Assurance Activities:

- Significant irregularities noted in the field notebook during the sampling procedure.
- Results of performance and system audits, if conducted.

QA/QC data generated by the laboratory and a case narrative will be included in the CLP data packages.

Pertinent quality assurance documentation will be submitted to the following person at US EPA:

Addressee:

Mr. Ralph O. Howard, Jr.
Remedial Project Manager
United States Environmental Protection Agency
Region IV - Waste Management Division
345 Courtland Street, N.E.
Atlanta, GA 30365